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Benzene Alkylation With Ethylene Over a Boron Trifluoride Catalyst on a Carrier

917M0036C Moscow *KHIMICHESKAYA PROMYSHLENNOST* in Russian No 11, Nov 90 pp 11-13 (651-653)

[Article by Yu. I. Kozorezov]

UDC 66.095.253.7:[661.7.547.532]

[Abstract] The technology of the production of ethyl benzene based on alkylation of benzene with ethylene in presence of boron trifluoride was purchased from abroad. In the present paper, based on the patent data, the details of this process have been reported. Originally this process was developed by the American Company UOP (the Alcar process). The use of boron trifluoride as an alkylating agent has been known for a long time, some of the Soviet studies in this area going back to 1949. The unique aspect of the Alcar process was the fact that boron trifluoride was used in an adsorbed state over a neutral carrier and not complexed with strong inorganic acids. Because of this carrier, the catalyst exhibited very high activity and was easily separated from the reaction products. The carriers consisted of aluminum and zirconium oxides, magnesium silicate, mixed silicon, aluminum and zirconium oxides, aluminum silicate etc. Various aromatic hydrocarbons, including polycyclic ones can be used in this reaction. The products formed can be trans-alkylated over the same catalyst. The principal disadvantage of this process is the use of boron trifluoride itself, an expensive, aggressive reagent requiring special handling. Consumption of the catalyst is directly related to the moisture in the reagents. Recent studies showed that this catalyst may be regenerated, lowering the initial investment in this process. References 12: 4 Russian, 8 Western.

Formation of a Catalytic System and Epoxidation of Olefins With Hydrogen Peroxide Under Conditions of Interphase Catalysis

917M0037D Moscow *NEFTEKHIMIYA* in Russian Vol 30 No 3, Sep-Oct 90 (manuscript received 4 Jun 90) pp 602-608

[Article by T.V. Dovganyuk, V.V. Berentsveyg, E.A. Karakhanov and A.A. Borisenko, Moscow State University imeni M. V. Lomonosov]

UDC 47.313:42.943.6

[Abstract] In the previous work epoxidation of octene-1 with hydrogen peroxide was investigated in the system water-dichloroethane in presence of tungsten and phosphate ions as catalysts and trioctylbenzylammonium chloride as the interphase transfer agent. It was proposed that the real epoxidation agent in this system are the in situ formed peroxy heteropolyanions with a ratio of $P:W:O_{act}=1:4:8$. In this paper an attempt was made to explain the influence of the olefine and pH of the

aqueous phase on the epoxidation rate and to evaluate the in situ formed catalytic system by means of NMR ^{31}P spectroscopy. Changing the substituents on the double bond, it was established that the transfer of oxygen from the catalyst to the substrate is electrophilic. Protonation of the anion $PW_4O_{24}^{3-}$ at the phase separation border led to a partial quenching of the negative charge resulting in an increased electrophilic potential of the peroxide oxygen which facilitated the reaction of the oxidizing agent with the substrate. This led to an increased epoxidation rate of the olefines with the catalyst forming in more acid media. The selectivity of the oxidation of olefines to respective oxides was about 90-96%. Figures 4; references 7: 4 Russian, 3 Western.

Inclusion Compounds in Zeolites as Catalysts for Petrochemical Processes

917M0037E Moscow *NEFTEKHIMIYA* in Russian Vol 30 No 3, Sep-Oct 90 (manuscript received 26 Mar 90) pp 617-625

[Article by B.V. Romanovskiy and A.G. Gabriyelov, Moscow State University imeni M. V. Lomonosov]

UDC 541.49:541.128:546.72

[Abstract] A review type article devoted to scientific principles of the preparation of a new class catalysts, the metal complexed inclusion compounds in zeolite matrixes. The phthalocyanic complexes of transition metals trapped in zeolite pores are included in this group of catalysts. A series of examples of the application of these catalysts was recited: oxidation of various hydrocarbons, alcohols and sulfur containing compounds, reactions of hydrocarbon and nitrogen oxides, decomposition of hydrogen peroxide, butyl mercaptan, cyclohexane peroxide, etc. Overall, these examples showed their wide spectrum of applications as promising new catalytic reagents. They are of special interest in stereospecific reactions since they combine the unique molecular sieve properties with great specificity characteristic of complexed metallic catalysts. Figure 3; references 16: 5 Russian, 11 Western (2 by Russian authors).

Molecular-Mass Distribution of N-Alkylpiperidine, Synthetic Product From CO, H₂ and Piperidine on Molten Iron Catalyst

917M0037F Moscow *NEFTEKHIMIYA* in Russian Vol 30 No 3, Sep-Oct 90 (manuscript received 17 May 90) pp 626-630

[Article by L.S. Glebov, G.A. Kliger and S.M. Loktev, Institute of Petrochemical Synthesis imeni A. V. Topchiev, USSR Academy of Sciences, Moscow]

UDC 547.422.542.97

[Abstract] The goal of this project was to investigate the effect of the composition of the promoted, reduced,

molten iron catalyst (PRMIC) and the reaction conditions on molecular-mass distribution (MMD) of N-alkylpiperidines obtained by the Fischer-Tropsch reaction from carbon monoxide, hydrogen and piperidine. In case of N-alkylpiperidines formed in presence of vanadium pentoxide promoted catalyst, a deviation of experimental data was observed from the data calculated by the Flora equation and plotted in semi-logarithmic coordinates. This agreed well with the assumption expressed by the authors and their observation that this is a general phenomenon. Possible mechanisms of the growth of the hydrocarbon chain were considered leading to various MMD of the synthetic products. Figures 2; references 13: 1 Russian, 12 Western (2 by Russian authors).

Oxidative Condensation of Methane to Ethylene Over Lithium- Magnesium Catalysts

917M0037G Moscow NEFTEKHIMIYA in Russian
Vol 30 No 3, Sep-Oct 90 (manuscript received 6 Feb 89)
pp 656-663

[Article by R. Lyakhovich, K. Skutil and M. Taniyevski, Silesian Polytechnical Institute, Gliwice, Polish Peoples Republic]

UDC 542.943.7:542.953:547.211:546.46:546.34:411.1

[Abstract] Recent publications on catalytic oxidative condensation of methane to ethylene and ethane showed considerable progress achieved in this area. However, some fundamental processes have not been adequately covered to this time, such as recombination of methyl radicals in the gaseous phase and on the surface of the catalyst, possible role of carbenes, relative role of the conversion of ethane to ethylene, etc.). Literature and authors' own data were analyzed concentrating on the catalyst Li/MgO in presence of air, oxygen and the mixture of O₂ and CO₂. The conversion of CH₄ ranged from 24.2 to 29.9%, selectivity of the formation of C-2 and higher hydrocarbons was 46.2 and of the CO_x - 57.1%. Best results were obtained with the catalyst containing 1% Li; a decrease of Li to 0.5% resulted in the formation of considerable amounts of CO; higher content of Li (1-8.7%) resulted in an almost exclusive formation of CO₂. Quartz reactor gave higher conversions of methane and showed higher selectivity of the process for ethylene and higher hydrocarbons than the stainless steel reactor. The catalyst was quite stable and the spent material could be regenerated by treatment with lithium acetate or lithium chloride solutions. References 22: 5 Russian, 17 Western.

Oxidation of Petroleum Sulfides With Hydrogen Peroxide in Presence of Alternating Valence Metal Compounds

917M0037H Moscow NEFTEKHIMIYA in Russian
Vol 30 No 3, Sep-Oct 90 (manuscript received 21 Jan 90) pp 692-696

[Article by A.Kh. Sharipov, R.M. Masagutov, I.S. Fayz Rakhmanov and Z.A. Suleymanova, Scientific Research

Institute of Petrochemical Plants, USSR Ministry of Petrochemical Processing, Ufa]

UDC 665.7.033.52:542.943.6

[Abstract] Oxidation of petroleum sulfides with hydrogen peroxide was studied in presence of vanadium, tungsten, molybdenum and iron. The first three metals accelerate oxidation of sulfides to sulfoxides, the molybdenum compounds being the most active. In small quantities, iron compounds showed no effect on the yield of sulfoxides but accelerated formations of acids (carboxylic acid increased 7-fold and sulfonic 2.5-fold). To obtain sulfoxides with low acid content, the starting material should contain less than $1 \times 10^{-6}\%$ of iron ions. Figure 1; references 10: 9 Russian (1 by Western authors), 1 Western (1 by Russian authors).

Quantitative Determination of Lead Microadmixture in Direct Distillation Benzene

917M0037I Moscow NEFTEKHIMIYA in Russian
Vol 30 No 3, Sep-Oct 90 (manuscript received 6 Apr 90)
pp 712-717

[Article by N.P. Volynskiy, L.I. Perepelitchenko and R.A. Karakhanov, Institute of Petrochemical Synthesis imeni A. V. Topchiev, USSR Academy of Sciences, Moscow]

UDC 665.73:546.819:543.432

[Abstract] Because of the need for a reliable method for analysis of micro-quantities of lead in direct distillation benzene, the existing photometric method was recalculated to find its deficiencies and to improve it to the point of making it a useful and reliable method. The method is based on mineralization of organic lead compounds with bromine followed by their removal with dithizone and photometric readout. The causes for previous errors were identified, the methodology was simplified leading to improved reproducibility and accuracy, comparable now to atomic absorption analysis. The time required for the assay was shortened to 40 min. The stability of chloroform solution of lead dithizone on storage was increased to 14 hrs. Figures 2; references 9: 8 Russian (3 by Western authors), 1 Western.

Mechanism of Corrosion Breakdown of Porous Ceramic Materials Under Influence of an Electric Field

917M0044D Kiev KHIMICHESKAYA
TEKHOLOGIYA in Russian No 6, Nov- Dec 90
(manuscript received 16 Apr 90) pp 63-69

[Article by S.M. Logvinkov, G.D. Semenenko, S.V. Tishchenko and L.P. Gurenko, Kharkov Polytechnical Institute]

UDC 666.76:622.791

[Abstract] The use of ceramic materials is increasing continuously; the conditions under which they are operating become increasingly more demanding. Based on their own experience, the authors analyzed various reasons for the breakdown of ceramic materials based on Al_2O_3 and SiO_2 after a long time performance in strong electric fields at temperatures reaching 800°C , exposed to chloride electrolytes and oxidizers. The authors analyzed the effects of the energy, high temperature, aggressive media and mechanical load. The following breakdown mechanisms were assumed to be involved: increased number of crystalline defects which interact with each other resulting in local adsorption centers which lead to the formation of colloidal structures as well as of energy absorption centers in which the pressure and temperature reach considerable levels resulting in possible solid phase reactions. Oxygen acts as a bridging agent in the crystalline structure leading to more structural defects. Under the influence of wedge forming pressure, external electric field and the mechanical load, the cracks are enlarged. Figures 1; references: 13 (Russian, 2 by Western authors).

Calculation of Porous Liquid Atomizers

917M0044E Kiev *KHIMICHESKAYA
TEKHNOLOGIYA* in Russian No 6, Nov-Dec 90
(manuscript received 11 Aug 89) pp 73-75

[Article by V.D. Chervyakov, O.V. Maminov and F.A. Mustashkin, Kazan Chemical-Technological Institute]

UDC 532.685

[Abstract] Various liquid dispersion processes are widely used in chemical industry, among them the rotating porous liquid atomizers have the potential of being most effective, providing continuous, uniform jets of the dispersing liquid. The factor which slows down their utilization is the lack of a methodology for calculating their parameters. In the present paper a calculation method was proposed for such atomizers made from abrasive materials and metallic ceramics. The following properties of the dispersing liquid are used in calculations: average droplet diameter, average consumption of the liquid, and the height of atomizing jet. References: 5 (Russian).

Oxidation of Carbon Monoxide on Highly Porous Metal Materials

917M0050F Leningrad *ZHURNAL PRIKLADNOY
KHIMII* in Russian Vol 63 No 10, Oct 90 (manuscript
received 2 Aug 89) pp 2169-2173

[Article by V.N. Antsiferov, A.A. Fedorov, and L.N. Rusinova, Republic Engineering-Technical Center of Powder Metallurgy]

UDC 546.71/74:546.26.262.3-31:542.943.7

[Abstract] A study is made of the catalytic activity of highly porous cellular materials made of copper, nickel, and alloys based on Cu, Ni, and Fe in the oxidation of carbon monoxide, as well as the nature of the reaction of CO with the surfaces of these materials. Studies were performed by a pulse method in a microcatalytic reactor. The $\text{CO}:\text{O}_2$ ratio in all pulses was stoichiometric. The volume of the catalyst was $0.2-1.0\text{ cm}^3$, the helium carrier gas flow rate was $30\text{ cm}^3/\text{min}$, and the pulse volume was $0.3-0.8\text{ cm}^3$. The gas composition at the output of the reactor was analyzed chromatographically. The highly porous materials based on copper and its alloys were found to be promising for the development of low-temperature CO oxidation catalysts. Carbon monoxide reacts with surface oxides on materials, going partially into the adsorbed states. The active components of the system determining the rate of the process are the surface compounds containing monovalent metal ions. Figures 2; References 15; Russian.

Activity of Modified Magnesium-Molybdenum Catalysts in Oxidative Dehydrogenation of n-Butane

917M0050G Leningrad *ZHURNAL PRIKLADNOY
KHIMII* in Russian Vol 63 No 10, Oct 90 (manuscript
received 21 Apr 89) pp 2333-2336

[Article by V.A. Doroshenko, Ye.A. Fedorova, and D.N. Tmenov, Institute of Bioorganic Chemistry and Petrochemistry, Ukrainian Academy of Sciences]

UDC 547.212:542.943:542.973

[Abstract] A study was made of the influence of modifying additives of the oxides of vanadium, chromium, manganese, iron, cobalt, and nickel on the activity of a magnesium-molybdenum catalyst in the oxidative dehydrogenation of n-butane to butadiene. The activity of the catalyst was determined under unsteady conditions, without oxygen in the gas phase. The process was performed in a flow-through quartz reactor with a fluidized bed of catalyst in dehydrogenation-regeneration cycles with a diluting agent blown through after each cycle. It was found that the greatest conversion of n-butane, yield of butadiene, and selectivity for it were achieved on catalysts modified by oxides of vanadium, manganese, and iron, the optimal content of which is 0.2-1 mass percent. The greatest activity was seen in specimens containing vanadium oxide. Figure 1; References 8; Russian.

Oxidation of Concentrated Ammonium-Oxygen Mixtures on a Platinoid Catalyst

917M0069F Kiev *KHIMICHESKAYA
TEKHNOLOGIYA* in Russian No 1, Jan-Feb 91
(manuscript received 20 Jun 90) pp 96-99

[Article by V.N. Cherkashin, Zh.F. Kharitonova, S.I. Samoylenko, and N.P. Levshin, Kharkov Polytechnic Institute]

UDC 661.566

[Abstract] Previous research confirms the high economic effectiveness of using process oxygen in the production of nitric acid. Besides reducing material and transportation costs, the technique reduces the amounts of toxic emissions into the atmosphere. The possibility of obtaining concentrated nitrous gases by the oxidation of ammonium-oxygen mixtures has been demonstrated elsewhere. Because of the need to use large amounts of platinoids, however, the process has a low efficiency. In an effort to improve the efficiency of the process, the authors of the study reported herein examined the feasibility of oxidizing concentrated ammonium-oxygen mixtures on a tube-shaped platinoid catalyst. The process was studied at several different contact temperatures,

linear gas velocities, catalyst strengths, and ratios of O_2 to NH_3 on contact tubes with diameters of 0.003, 0.005, and 0.008 m and lengths of 0.1, 0.2, and 0.3 m. A full factorial experiment based on a two-level model was designed to discover quantitative dependences between the process parameters. It was discovered that the yield of nitrogen (II) oxide on the type of contact element examined reaches 96-97% given the following conditions: strength of the catalyst with respect to ammonium, 300-400 kg $NH_3/(m^2Pt \times d)$; $O_2:NH_3$ ratio, 1.8; and contact temperature, 1,130 K. A regression equation for the aforesaid full factorial experiment based on a two-level model was derived. The calculated data were found to be in good agreement with the experimental data. Figures 4, tables 1; references 8 (Russian).

Comparison of Slotted Sieves for Grinding and Screening Chemical Powders

917M0014A Moscow *KHIMICHESKOYE I NEFTYANOYE MASHINOSTROYENIYE in Russian* No 10, Oct 90, pp 2-3

[Article by Ye.M. Sechko, A.N. Shugurov, N.G. Savostyanova, and G.N. Zabolotskikh]

UDC 677.532

[Abstract] The Scientific Research Institute of Chemical Polymers and the Severodonets Branch of the Ukrainian Scientific Research Institute for Chemical Machinery developed a new combination of machinery for grinding chemicals. The device consisted of a ball mill, a feeder, and a grinding separator. The grinding separator involved a squirrel cage-type screen and an augered rotor with a hinged spindle attached to rollers. The augered rotor transported the ground powder to the screen. The machine was capable of handling 200 kg per hour with a temperature in the grinding zone of 30°. Sheets of 0.18 mm and 0.45 mm thickness with etched and perforated openings of 0.14 mm diameter were initially used to form the screen surface. The use of a grinding separator permitted the removal of sand, cinders, fibers agglomerates, and other impurities. However, the operating lifetime of the screens, 10-12 hours, was too short. They were therefore replaced with a cylindrical welded slotted sieve, which was used for more than 500 hours but then experienced weld failure. The sieve was constructed from trapezoidal steel wire coils, with slots between neighboring coils. With proper welds the operating lifetime of the sieve should exceed 6 months. The equipment was tested with 2-mercaptobenzthiozol and gave a 0.005% residue. Figures 2.

Multipurpose Apparatus for Chemical and Microbiological Industry

917M0014B Moscow *KHIMICHESKOYE I NEFTYANOYE MASHINOSTROYENIYE in Russian* No 10, Oct 90 p 4

[Article by M.L. Katalkherman and V.N. Godukhin]

UDC 66.023+663.1.03

[Abstract] Multifunctional equipment is promising for the reaction, filtration, washing, and drying of products in the chemical and pharmaceutical industries. In contrast to the apparatus distributed by Zeitz and Shenk, which involves a rotating filtration partition, equipment has been designed in the Soviet Union that uses separate areas for reaction and filtration processes. The two areas are separated by a false floor. Mixing is accomplished by a heavy-duty shaft, which also serves as the outlet coupling for the filters. Drying is by means of a steam jacket or auxiliary heaters. The apparatus may be used under sealed, sterile conditions. The Penzmash Scientific Industrial Organization plans to produce two

models, with and without drying capability, in 1992-1993. The design capacity, 1.6 m³, has been determined to be optimal for this design. Apparatus of this stationary design is less expensive than that offered by the German firms. Figures 1.

Predicting the Reliability of Equipment From Its Testing by Way of the Example of a Rotary Drier

917M0014C Moscow *KHIMICHESKOYE I NEFTYANOYE MASHINOSTROYENIYE in Russian* No 10, Oct 90 pp 6-8

[Article by R.G. Mannapov, candidate of technological sciences]

UDC 66.02-192

[Abstract] A method is presented for analyzing and using supplementary statistical information in order to increase the reliability of predictions of the remaining operating lifetime of equipment. The BN-3.2-22 rotary drier in the drying of copper concentrate is used as an example. The remaining thickness of the shell wall was measured at various points along the shell surface with an ultrasonic thickness gage. The surface area was divided into five zones, and results obtained for three of them were determined by the Student's t test so as not to differ in a statistically significant manner. Results gave a straight line when plotted on Weibull probability paper, which indicates that they correspond to the theoretical Weibull distribution and therefore can be subjected to the statistical methods given in RD 26-10-87. When using a decrease in wall thickness from 20 mm to 10 mm over 5% of the surface area as boundary conditions, a service lifetime of 2.04 years was obtained at the 95% confidence level. This value is closer to the actually observed value of 2 years than the 1.88 years obtained when using traditional methods. Use of the RD-26-10-87 formulas is limited to cases where the mechanism of corrosion and/or erosion does not change with increasing depth. Figures 2; references 5 (Russian).

Residual Stress in Vessels Made of a Steel-and-Titanium Bimetal

917M0014D Moscow *KHIMICHESKOYE I NEFTYANOYE MASHINOSTROYENIYE in Russian* No 10, Oct 90 pp 10-11

[Article by Ye.V. Kuryleva, S.M. Kutepov, and V.N. Skorokhodov, candidate of technological sciences]

UDC 669.15'295-194.539.373

[Abstract] The effect of plastic deformation and thermal processing on the level of residual stress arising in vessel elements and apparatus constructed from steel-and-titanium bimetals was studied. The bimetals were produced by blast welding of titanium cladding onto VSt3 steel. The bimetals had moduli of elasticity and coefficients of expansion that differed from those of

either starting material. Both annealing at 650-680° and plastic deformations, including bending, rolling, and stamping, were found to reduce residual stress to levels very close to 0. Tensile stress remained between 17 and 18 MPa. This compressive residual stress increases the resistance of the bimetals to corrosion and metal fatigue. Figures 1; references 3, Russian.

Calculation of Zones of Dangerous Concentration During the Drainage Discharge of Fuel Gas

917M0014E Moscow *KHIMICHESKOYE I NEFTYANOYE MASHINOSTROYENIYE* in Russian No 10, Oct 90 pp 17-18

[Article by L.V. Averin, V.P. Tomilin, candidate of technological sciences, and Yu. A. Kondrashkov, candidate of physical and mathematical sciences]

UDC 532.517

[Abstract] A more accurate method for calculating the danger zone for discharge of fuel gas into a windy atmosphere was developed. Empirical formulas for the distribution of discharged gas in terms of diameter of the exit tube, densities and translational speeds of the discharged gas and air, molecular masses of gas and air, absolute temperature, and fractional volume are presented. Corrections were developed for both positive- and negative-buoyancy situations. When the ratio of the products of speed and density for the discharged gas is either approximately 1 or much larger than 1, useful approximations are possible. Graphs of the danger zone for hydrogen or methane discharge at 100 or 300 K are presented. Discharge of colder gas was found to be more dangerous. Figures 2; references 4, Russian.

Electrofilter With Composite Gas Pathway

917M0014F Moscow *KHIMICHESKOYE I NEFTYANOYE MASHINOSTROYENIYE* in Russian No 10, Oct 90 pp 21-23

[Article by L.P. Baranov, N.Ya. Golodnaya, A.K. Grishechkin, V.D. Novikov, and S.N. Khrapkov]

UDC 621.359.42

[Abstract] In order to correct aerodynamic deficiencies in existing designs for composite pathway electrostatic precipitators, the rod-shaped precipitating electrodes were replaced with flattened electrodes with folded ends. This modification greatly increased the available precipitating surface area. The mass of the new electrode was less than that of an 8-mm-diameter rod-shaped electrode by a factor of 1.5. The new electrode design also decreased warping at higher temperatures. The open side of the bends was placed at right angles to the direction of gas flow. As a result of the new design, the rate of gas flow in the precipitation zone was reduced to a more favorable level. Apparatus constructed with the modified

precipitating electrodes and hand-needle corona electrodes constructed by the Zaporozhye branch of the Scientific Research Institute for Gas Purification (which provide maximum power requirements for the corona discharge) gave a degree of gas purification, 99.6%, that is comparable to the best equipment currently available but that requires the use of markedly less metal and energy. The filter will be produced by the Gazoochistka Industrial Organization in Semibratovsk. Figures 6; references 4, Russian.

Technology for Production of Synthetic Phenols and Ways to Improve It

917M0036B Moscow *KHIMICHESKIY I PROMYSHLENNOST* in Russian No 11, Nov 90 pp 9-11 (649-651)

[Article by G. D. Kharlampovich, V. N. Vinogradova, Yu. V. Churkin, A. A. Kruglikov, B. D. Gritsenko, I. A. Petrova and L. V. Strukova]

UDC [661.7:547.562+661.7.547.563].002.237

[Abstract] Technology for production of o-cresol and 2,6-xylenol based on catalytic alkylation of phenol was developed. The most widely used catalyst was $\gamma\text{-Al}_2\text{O}_3$, the reaction being carried out in the vapor phase at atmospheric pressure. The advantages of this method include inexpensive catalyst, but the disadvantages concern low conversion rate of phenol, formation of some m- and p-cresols and production of primarily o-cresol. Most recently other methyl derivatives of phenol became important and therefore attempts were made to vary the catalyst and the production conditions to find new better synthetic methods. It was shown that, using the existing traditional equipment, it is possible to produce a wide range of methyl derivatives of phenol by changing the catalyst and possibly the reaction conditions. Figures 1; references 10; 9 Russian (3 by Western authors), 1 Western

Development of Flexible Technological Systems for Production of Methanol and Modernization of Operational Units

917M0036D Moscow *KHIMICHESKIY I PROMYSHLENNOST* in Russian No 11, Nov 90 pp 13-15 (653-655)

[Article by A.Ya. Rozovskiy, Yu.V. Lender, A.A. Lender, G.I. Lin, A.G. Krasnyanskaya and I. I. Krupnik]

UDC 661.721.41.002.237

[Abstract] There are a number of technical problems connected with large scale production of methanol, such as construction of new plants themselves, delivery and processing of large volumes of the reagents and extensive losses every time the production has to be interrupted or even slowed down. A new approach to solve this problem

was developed based on a two phase procedure. In the first phase the process is carried out on a number of flow reactors with increased heat removal; in the second phase it is carried out in a reactor with recycling gas. In the first phase a high productivity per processing unit is achieved and the second phase assures high degree of the processing of crude hydrocarbon. This is a flexible technology based on standard reactor units of relatively small capacity. As a result of this modification the overall capacity is increased and the catalyst performance is improved. Overall productivity increases with increased yield of methanol obtained in the first phase: the increase of the product is about 0.1 t/m^3 for each reactor used in the first phase. At the same time, the productivity of the second phase remains unchanged and no additional construction is required. Overall capacity of this modified process increases by 35 to 137%. Figure 1; references: 4 (Russian).

Formation of Propylene in Reaction of Methane With Acetylene Over Heterogenous Catalyst NiO_2/BN

91TM0045.1 Moscow IZVESTIYA AKADEMII NAUK SSSR: SERIYA KHIMICHESKAYA in Russian No 11, Nov 90 (manuscript received 1 Sep 89) pp 2478-2481

[Article by Ye.F. Kvashina, N.V. Chapisheva, Ye.Yu. Grankina, V.N. Chukalin, I.N. Isleva and Yu.G. Borodko, Division of Institute of Chemical Physics imeni N.N. Semenov, USSR Academy of Sciences, Chernogolovka]

UDC 541.128.13.547.313.3.542.91.547.211.547.314.2

[Abstract] An attempt was made to determine whether the propylene forming in the reaction of methane and acetylene is the product of an inter-conversion of acetylene or the result of hydromethylation of acetylene. Using ^{13}C tagged methane, it was shown that: the yield of propylene in a reaction over NiO_2/BN and in the temperature range $300\text{--}450^\circ\text{C}$ was higher when a $\text{CH}_4/\text{C}_2\text{H}_2 = 1$ mixture was used than in the case of pure acetylene. It was shown that propylene forms both by the hydromethylation of acetylene with methane as well as by conversion of acetylene. The ratio of the "heavy" to "light" propylene in the mixture was 1:4. Figure 1; references: 6 (Russian, 1 by Western author).

Synthesis of Alkylpyridines From CO , C_2H_4 , H_2 and NH_3 Over Heterogenous Catalysts

91TM0045B Moscow IZVESTIYA AKADEMII NAUK SSSR: SERIYA KHIMICHESKAYA in Russian No 11, Nov 90 (manuscript received 19 Jun 89) pp 2481-2486

[Article by B.S. Kosolapova, D.Z. Levin, S.D. Sominskiy, L.F. Rar, Ye.S. Mortikov and A.L. Lapidus, Institute of Organic Chemistry imeni N.D. Zelinskiy, USSR Academy of Sciences, Moscow]

UDC 541.128.13.542.91.547.821.4

[Abstract] The goal of this work was to investigate the possibility of synthesizing alkylpyridine from CO , C_2H_4 , H_2 and NH_3 over bi-functional heterogenous Rh-containing catalysts. The principal product obtained in 80% yield was 2-ethyl-3,5-dimethylpyridine. In total about 16 other compounds were noted, some of which were identified. It was shown that the activity and selectivity of the catalyst depended on the content of Rh and the nature of the carrier. Initial pressure of the starting gases and the content of NH_3 component also affected the yield of the final product. Using IR spectroscopy, it was shown that the acidity of the catalyst related directly to their activity, the lower the concentration and strength of acid centers on the surface of the catalyst, the lower was the formation of pyridines. Figures 3; references 6: 3 Russian (1 by Western author), 3 Western.

Effect of Reduction Temperature on Formation and Activity of Bimetallic Ni-Tc-C Catalysts

91TM0045C Moscow IZVESTIYA AKADEMII NAUK SSSR: SERIYA KHIMICHESKAYA in Russian No 11, Nov 90 (manuscript received 12 May 89) pp 2486-2490

[Article by G.N. Pirogova, N.N. Popova, V.V. Matveyev and A.Ye. Chalykh, Institute of Physical Chemistry, USSR Academy of Sciences, Moscow]

UDC 541.12.036.541.128.34.546.74.546.718

[Abstract] Addition of Tc to impregnated platinum catalysts leads to a synergistic increase in the activity of bimetallic catalysts, as compared to monometallic reagents. In the present work the effect of the temperature on the formation and catalytic activity of the system $\text{Ni-Tc}/\gamma\text{-Al}_2\text{O}_3$ was investigated in dehydration of cyclohexane and dehydrocyclization of n-hexane. The most active bimetallic catalysts were obtained at $T_{\text{red}} = 700\text{--}800^\circ\text{C}$. The synergistic effect of the bimetallic catalyst was demonstrated by lower initial reaction temperature and higher yield of the aromatic product. The most striking effect was observed with the catalyst containing a 11:1 ratio of Ni-Tc. On the surface of the catalyst the pressure was noted of metallic TcO_2 , NiCl_2 and spinels of NiAl_2O_4 along with clusters of Ni-Tc. These clusters were evidently responsible for the synergistic increase of the catalytic activity. Figures 4; references: 3 (Russian).

IR-Spectroscopic Study of Influence of Reaction Medium on Cobalt State in 10% $\text{Co}/\text{Al}_2\text{O}_3$ Catalyst for Synthesis of Aliphatic Hydrocarbons From CO and H_2

91TM0045D Moscow IZVESTIYA AKADEMII NAUK SSSR: SERIYA KHIMICHESKAYA in Russian No 11, Nov 90 (manuscript received 15 Feb 90) pp 2640-2643

[Article by A.V. Zaytsev, G.V. Kozlova, V.Yu. Borovkov, A.Yu. Krylova, A.L. Lapidus and V.B.

Kazanskiy, Institute of Organic Chemistry imeni N.D. Zelinskiy, USSR Academy of Sciences, Moscow]

UDC

543.422.4:541.12.038:541.128:546.732:542.91:547.21

[Abstract] The goal of the present work was to investigate the effect of the reaction medium on the condition of the surface of a 10% Co/Al₂O₃ catalyst used in synthesis of hydrocarbons from CO and H₂; the diffuse dispersion IR-spectroscopy methodology was used in this study. The adsorption of CO on ionic and metallic forms of Co was noted in the linear and bridge forms. It was shown that after a prolonged treatment with hydrogen and carbon monoxide, the surface of the ionic and metallic Co could adsorb the CO, although the surface of the metallic Co underwent considerable changes indicated by the shift of the IR absorption bands towards the red. This shift is accompanied with a decrease of the metal-carbon bond strength in the adsorbed Co⁰ complex. During the treatment of the Co-catalysts with the synthesis gas, a significant change occurs in the selectivity of the process resulting in a decreased yield of gaseous substances and increased yield of liquid reaction products. Figure 1; references 14: 8 Russian (1 by Western authors), 6 Western (1 by Russian authors).

Use of Cassette-Type Apparatus for Membrane Filtration Processes

917M0050H Leningrad ZHURNAL PRIKLADNOY KHMII in Russian Vol 63 No 10, Oct 90 (manuscript received 28 May 90) pp 2249-2253

[Article by N.A. Martsulevich, V.A. Gulyarenko, and V.P. Kononov, Scientific Research Institute of Physical Chemistry Problems, Belorussia State University imeni V.I. Lenin]

UDC 66.064:542.64

[Abstract] When a specific type of membrane is used in an industrial process, the effectiveness of filtration depends on the surface area of the membrane per unit volume of the equipment, uniform distribution of the initial flow over the entire separation surface, and the nature of movement of the medium through the apparatus to minimize the influence of concentration polarization on membrane permeability. This article discusses the advantages and disadvantages of equipment with hollow fibers and cassette-type equipment. Cassette-type modules contain turbulizers in the separating screens that ensure a guaranteed gap between the membranes and provide the necessary channel thickness. The hydrodynamics in the channels of the module have a particular influence on the characteristics of the separation process. A full study of the processes of separation in cassette-type equipment must therefore be started with a study of the hydrodynamic characteristics of the equipment. In some cases, physically well founded and reliable

methods of design of ultrafiltration processes can be developed in this early stage. This allows the development of a method for the design of cassette-type equipment to determine the necessary number of membrane elements for a specific process. Figure 1; References 14: Russian.

Use of Membrane Methods in Various Stages of Biotechnology

917M0050I Leningrad ZHURNAL PRIKLADNOY KHMII in Russian Vol 63 No 10, Oct 90 (manuscript received 18 Jul 89) pp 2253-2257

[Article by V.N. Gomolitskiy, V.T. Goloveshkin, I.K. Kalinina, and N.N. Sminov]

UDC 66.067:577.112.083

[Abstract] The purpose of this study was to provide a foundation for combined utilization of membrane methods such as microfiltration, including sterilizing filtration and ultrafiltration or diafiltration, and to develop a technological plan and arrangement of hardware for separation and purification of biological preparations. A plan is suggested for combined utilization of prefiltration, microfiltration, ultrafiltration, and diafiltration as well as sterilizing filtration as a part of the full biotechnological cycle of production of biological preparations. A universal filtration apparatus and an apparatus with interchangeable hollow fibers have been developed and are used as the basis for design of an installation for optimal technological production of biological preparations. A diagram of the installation for separation, concentration, and diafiltration of biopolymer solutions is presented. Figures 2; References 4: 3 Russian, 1 Western.

Extractive Refining and Production of High-Purity Hafnium Dioxide

917M0069A Kiev KHMICHESKAYA TEKHNologiya in Russian No 1, Jan-Feb 91 (manuscript received 26 May 90) pp 18-22

[Article by I.V. Vinarov, A.I. Orlov, L.P. Grigoryeva, and L.I. Ilchenko, Odessa Physical Chemistry Institute]

UDC 661.883.2:669...4:66.021.06

[Abstract] Existing specifications call for the production of type grades of hafnium dioxide. The content of ZrO₂ in purer grade, i.e., GFO-1, must not exceed 0.3%. When hafnium dioxide is required for scientific research purposes and for purposes of manufacturing improved series of standard specimens, however, the content of ZrO₂ must be reduced to between 0.01 and 0.001%. The authors of the study reported herein examined possible techniques for producing hafnium dioxide with this level of purity. The refining technique they developed was based on the use of ketones to separate zirconium and hafnium rhodanides. Cyclohexanone was selected as the

extractive reagent. A two-stage extraction process was discovered to be sufficient when ZrO_2 is present in an amount of $10^{-2}\%$ or less; for hafnium dioxide containing $10^{-3}\%$ ZrO_2 or more, a three-stage extraction process is required. The process and resulting product were monitored primarily by using spectral (and sometimes chemical) methods. The extraction technology developed, which is described in detail, was tested under shop conditions and then introduced at a pilot plant of the Physical Chemistry Institute of the UkSSR Academy of Sciences. Data from the central plant laboratory regarding the results of using the new extraction process indicated that when compared with the purest available standard product, the ZrO_2 content in the hafnium dioxide refined by using the new extractive refining technique was reduced by a factor of 300, and the contents of the other impurities tested were also reduced by one or two orders of magnitude. The direct yield of hafnium in a product containing $Zr_2 \leq 10^{-2}\%$ amounted to 65%; in the purest hafnium dioxide, which contained $10^{-3}\%$ ZrO_2 , the direct yield of hafnium amounted to 50%. With respect to the actual amount of hafnium expended, these outputs amounted to 71 and 63%, respectively. These results were, of course, deemed acceptable, and the new extractive refining technology was introduced at the plant. A counterflow extractive refining technique was also developed to achieve the highest possible degree of hafnium refining. This technique, which is also described in detail, resulted in a high direct yield of hafnium after six stages of continuous counterflow extraction (about 95%) and thus proved to be much more effective than a single-stage periodic process. A 12-stage counterflow system tested resulted in an end product that was virtually entirely hafnium. Analysis of concentration curves derived for the counterflow procedure indicated that even seven or eight stages of counterflow extraction is sufficient to purify the product to $3 \times 10^{-2}\%$ ZrO_2 . Small single-stage vertical centrifugal extractors that were made of titanium and that had a rotation speed of 2,800 rpm were developed for use with the continuous counterflow version of the extractive refining process. A process flow that included a battery of six of these extractors was also successfully tested. Figure 1, tables 3; references 7 (Russian).

Synthesis of Organoaminoalkoxysilanes and Their Reactions With Triethyl Silane

917M0069B Kiev *KHIMICHESKAYA
TEKHNOLOGIYA* in Russian No 1, Jan-Feb 91
(manuscript received 16 Sep 88) pp 30-34

[Article by A.G. Tseytlin, V.M. Kopylov, M.I. Shkolnik, and V.V. Kireyev, Moscow Forestry Engineering Institute]

UDC 547.245

[Abstract] Organosilicon monomers containing alkoxy and amine groups have always attracted the attention of researchers because they are used as binding agents and

in the production of oligomers and polymers with reactive groups in their chain. In this vein, the authors of the study reported herein examined the reactivity of vinyl- and hydrideorganoaminoalkoxysilanes with different alkoxy and diethylamine groups as they react with triethyl silanol. The starting organoaminoalkoxysilanes were synthesized by using a two-stage method that included partial etherification of the starting organochlorosilanes and subsequent aminolysis of the organoalkoxychlorosilanes. Gas-liquid chromatographic analysis of the reaction products indicated that the process of partial etherification predominantly entails the formation of end alkoxychlorosilanes. Aminolysis of the alkoxychlorosilanes was found to occur without complications due to side reactions and with quantitative formation of the end products. The promise of using organoaminoalkoxychlorosilanes in a heterofunctional condensation reaction with hydroxyl-containing compounds was assessed by investigating their reactivity in a model reaction with triethyl silanol. The said reaction was found to occur solely with respect to the amino group at the silicon atom; the reaction did not affect the Si-H or Si-OR groups. The room-temperature reaction of the organoaminoalkoxychlorosilanes studied with triethylsilane in an equimolar ratio was thus shown to occur primarily with respect to the aminosilyl group and to have a second overall reaction order with respect to the reagents. The reactivity of alkoxychlorosilanes was found to increase as the sizes of the substituents decrease, with the greatest contribution to the change in reactivity being made by a change in substituents at the silicon atom and with the nature of the alkyl substituent in the alkoxy group having an insignificant effect. The gas-liquid chromatography studies were performed on an LKhM-80 (model 6) gas-liquid chromatograph. The makeup and structure of all of the compounds synthesized were confirmed by data from elemental analysis and by paramagnetic resonance spectroscopy studies. A Bruker WH-90 pulsed spectrometer with a working frequency of 60 MHz was used. Figure 1, tables 3; references 6: 4 Russian, 2 Western.

Using Thermal Power Plant Ash To Treat Sewage for Subsequent Use in the Production of Nitrolinoleum

917M0069C Kiev *KHIMICHESKAYA
TEKHNOLOGIYA* in Russian No 1, Jan-Feb 91
(manuscript received 20 Aug 90) pp 34-37

[Article by A.N. Perkov, Priroda Special Technological Design Office, Kemerovo]

UDC 663.631.8

[Abstract] The effectiveness of using thermal power plant [TES] ash for the adsorption cleaning of sewage has already been demonstrated at the Kemerovo Aniline Dye Plant. The use of TES ash is not without its problems, however. When used as a sorbent, the ash becomes contaminated with highly toxic organic and

mineral compounds. Because of its potential environmental hazard, this ash can neither be stored in ash dumps nor used elsewhere. Others have suggested that the problem of what to do with ash used as a sorbent be solved by first neutralizing the ash and then using it to produce mineral filler for various polymers. Previously published results of laboratory tests of mineral filler used to produce rubber products and soft carpet materials have shown promise. But the amounts of TES ash slated for use as sorbents in treating sewage will far exceed the amounts called for in the aforementioned mineral filler technology. The study reported herein examines the feasibility of further expanding the use of mineral filler produced from neutralized spent TES ash by using it in the production of nitrolinoleum. Composites of nitrolinoleum were prepared in a Werner-Pfleiderer-type laboratory mixer in accordance with the stipulated procedure, and the formulas of the nitrolinoleum specimens were determined. A decision was made to add mineral filler to the nitrolinoleum composition in an amount ranging from 2.0 to 4.0% owing to the equivalent reduction of asbestos, whiting, and red ocher. Nitrolinoleum specimens were rolled on smooth laboratory rollers with a working temperature between 343 and 348 K. The process of rolling linoleum compound containing no more than 4% mineral filler was in no way different from that of rolling regulation specimens. Increasing the mineral filler content to 5% did have a negative effect on the processability of the mixture and quality of the finished product, however. The compound became very stiff and did not form into a good "mesh." Specimens of linoleum produced by the proposed method of substituting mineral filler for a portion of their other ingredients were conducted in accordance with Branch Standard 84-306-70. The tests showed that using mineral filler in place of an equal amount of asbestos or an equal amount of whiting produced acceptable results. Using mineral filler in place of asbestos did, however, result in higher physicomechanical indicators than did using mineral filler in place of an equal amount of whiting. Attempts to use mineral filler in place of an equal amount of red ocher proved to be unsuccessful. The proposed technique of using mineral filler made of spent TES ash that had previously been used as a sorbent to treat sewage did not appear to present any technological problems. Furthermore, the estimated cost of the mineral filler (2.5 to 3.0 rubles per metric ton) is lower than the cost of the conventionally used materials by a factor of 3 or 4. The research reported thus confirmed the feasibility of using the aforesaid mineral filler in the production of linoleum. Tables 2; references 9 (Russian).

Indicating Reversibility and Making a Pre-experiment Calculation of Equilibria in Chemical Reactions

917M0069D Kiev *KHIMICHESKAYA
TEKHNLOGIYA* in Russian No 1, Jan-Feb 91
(manuscript received 27 Apr 90) pp 52-57

[Article by S.A. Payusov, A.M. Khalemskiy, and V.S. Krylov]

UDC 541.127

[Abstract] The end goal of any applied chemical study of reactions, particularly research conducted when a new chemical process is being formulated, is to obtain data regarding the reactions' rates and equilibria or reversibility. These two factors are especially important in that the former determines the productivity of the given process whereas the latter determines the degree to which the raw material is used. Determining equilibria (i.e., the equilibrium contents of the starting reagents and reaction products) presents particular problems because basic chemistry does not have any criteria for determining the moment of onset of equilibrium under conditions of a reaction. Rather, it is assumed that equilibrium has been reached if the makeup of the reagents in some segment of the reaction period remains unchanged. The moment at which equilibrium is reached thus becomes fuzzy in some indeterminate and often arbitrary experimental interval that is sometimes so large that the experimental conditions of detecting the makeup in this interval become metrologically incompatible with the initial conditions of determining the reagent contents. Experimental detection of equilibria thus not only lengthens the time required to obtain experimental data but also results in distortions that may in turn result in inaccurate information regarding reactions. The authors of this article propose a method of determining reversibility and calculating equilibria in chemical reactions. Once the researcher has at least three pieces of chemical-kinetic data, he can compute the coefficients of these data in an applied kinetics equation. The resultant coefficients (x , y , and z , respectively) will each represent a percentage of the initial (in absolute units) content of one of the starting reagents (the preferable reagent is the one with the lowest initial content). The signs of the coefficients are used to judge whether the given reaction is irreversible or whether equilibrium has been reached. The moment at which equilibrium is reached and the residual content of the main reagent (which serves as the basis for determining the kinetics and equilibrium of the given reaction) are computed by using equations presented by the authors. Once the residual content of the main reagent, an adequate chemical equation for the given reaction, and the conditions under which the reaction is being conducted are known, it becomes easy to calculate the degree to which the reaction has progressed (α) with respect to the main reagent and hence the equilibrium constant. Using the proposed procedure makes it possible to determine this equilibrium constant long before it can be detected experimentally. The proposed method saves researchers a great deal of time when determining chemical-technological data about the process they are investigating. From any first three kinetic results, a researcher can obtain information regarding the reversibility or irreversibility of a process and can establish the interval of the reaction period in which equilibrium should be sought. The onset of equilibrium can be determined rather precisely in less than half the time generally

required when using conventional procedures. Tables 2; references 8; 7 Russian, 1 Western.

Nitric Acid Decomposition of Apatite Concentrate From the Novopoltavskiy Deposit Under the Effect of Ultrasound

917M0069E Kiev *KHIMICHESKAYA
TEKHOLOGIYA* in Russian No 1, Jan-Feb 91
(manuscript received 19 May 88) pp 60-64

[Article by B.A. Bovykin, N.S. Tishkina, R.V. Kostyanets, and V.P. Shram, Dnepropetrovsk Chemical Technology Institute]

UDC 541.553.641.548.58:546.131

[Abstract] The shortage of the ores used to produce phosphorus and complex fertilizers is becoming increasingly acute. Consequently, it has become necessary to study new forms of raw materials that can be used to provide such fertilizers. Analysis of the elemental and chemical makeups of the ores present in the Novopoltavskiy deposit indicates that, along with phosphorous, it also consists of rare earth elements (between 1 and 4%), fluorine, titanium, tantalum, niobium, and iron. Because current processing techniques only permit the use of the apatite portion of the concentrate (which constitutes about 60%), the other valuable elements present in the concentrate are irretrievably lost. A portion of them pass into nitrogen-phosphorus solutions that contaminate the mineral fertilizers and lower their quality. In an effort to develop an integrated technology to process the ores from the Novopoltavskiy deposit, the authors of the study reported herein examined the effect of ultrasound on the nitric acid decomposition of apatite concentrate from the said deposit. The method of measuring the change in density of a solution of apatite concentrate during the course of nitric acid decomposition was used to study the kinetics of the process under the effect of ultrasound. The values of the rate constants and order of the nitric acid decomposition reaction were calculated on the basis of overall and component-by-component kinetic curves at 303, 313, and 323 K; at nitric acid concentrations of 30, 40, and 56%; and at ultrasound oscillation frequencies of 22 and 44 kHz. It was discovered that ultrasonic oscillations increase the decomposition rate only insignificantly, i.e., by 1 to 5 g/(l x s⁻¹). A kinetic equation of the process was derived. Figure 1, tables 2.

The Effect of a Magnetic Powder's Acid-Base Properties on the Solidification of Suspensions for Magnetic Tapes

917M0069G Kiev *KHIMICHESKAYA
TEKHOLOGIYA* in Russian No 1, Jan-Feb 91
(manuscript received 17 Mar 89) pp 103-104

[Article by V.I. Gumennyi, A.F. Yushchenko, L.A. Yurchenko, and L.A. Donets, Magnetic Information Carriers Scientific Research Institute, Shostka]

UDC 681.84.083.84.66.066+667.622.1

[Abstract] The process of isocyanate solidification of highly filled polymer composites is widely used in the domestic and world practice in manufacturing magnetic information carriers. This concise report presents the results of a study of the effect of one filler, i.e., magnetic powder of γ -iron oxide, on the rate of isocyanate solidification of a magnetic suspension used to produce magnetic tapes. The suspension studied consisted of methyl-ethylketone and cyclohexanone (in a 3.6:1 ratio) along with the following components (% by mass): γ -iron oxide, 28.00; a copolymer of vinylchloride, vinylacetate, and vinyl alcohol, 2.75; polyurethane rubber, 4.13; di(alkylpolyethylene glycol ester) of orthophosphoric acid, 0.84; commercial-grade carbon, 1.12; oleic acid, 0.42; an adduct of trimethylolpropane with 2,4-toluylenediisocyanate (triisocyanate TT-75), 2.00; and iron (III) acetylacetonate, 0.005. The reaction rate was estimated on the basis of the change in kinetic viscosity of a pre-prepared suspension after solidification catalyst had been added to it. Curves of the change in the kinetic viscosity of the suspensions were plotted. They confirmed that suspensions with magnetic powders that have the same chemical nature (γ -iron oxide) but are produced by different methods do indeed have different solidification rates. It was concluded that the acid-base properties of the surfaces of the crystals of the powders studied were one of the main factors responsible for these differences. This conclusion led the authors to further hypothesize that the acid-base properties of the surfaces of magnetic powders play a catalytic role in the process of the solidification of the suspensions studied. Figure 1; references 5 (Russian).

Reprocessing Slurries From Etching Processes

917M0069H Kiev *KHIMICHESKAYA
TEKHOLOGIYA* in Russian No 1, Jan-Feb 91
pp 105-106

[Article by A.S. Kovalchuk and V.M. Klyuyevskaya, Dneprodzerzhinsk Industrial Institute]

UDC 666.664(088.8)

[Abstract] This concise report discusses the advantages of reprocessing the slurries resulting from etching processes. The treating of wastewaters from etching departments with lime milk results in voluminous slurries containing mainly iron hydroxides and oxides and gypsum. The slurry has a moisture content of 90 to 96%. When this slurry is stored in tanks, environmental pollution results. In an attempt to alleviate this situation, a study was conducted to examine the feasibility of reprocessing the slurries resulting from etching processes. Slurries containing between 23 and 31% (by mass) Fe_{tot}, 20 and 22% CaO, and 20 and 25% SiO₂ along with insignificant amounts of Al₂O₃, MnO, and MgO were dried and pulverized in a ball mill under laboratory conditions so that the residue remaining on the sieve was between 0.006 and 2% by mass. The resultant mass was dehydrated and added to the basic raw material mixture

in an amount equal to 50%. Specimens of slab with dimensions of $(150 \times 150 \times 5.5) \times 10^{-3} \text{ m}^3$ were pressed under a pressure of 25 MPa. The specimens were dried at 240°C and annealed at 1,000°C for 30 minutes. They had a strength ranging from 12.5 to 14.5 MPa. The feasibility of using these slabs to manufacture different ceramic products, including vases and candlesticks, was confirmed under laboratory conditions. The authors thus demonstrated that using the slurries from etching departments in the construction industry, particularly when manufacturing ceramics, makes it possible to reduce raw material consumption, reduce annealing times, and reduce sintering temperatures while maintaining product quality. Using these slurries also makes it possible to eliminate one of the main sources of environmental pollution.

Using Ftorlon Fabric for the Diaphragms of Hydrochloric Acid Electrolyzers

917M00691 Kiev *KHIMICHESKAYA
TEKHNologiya* in Russian No 1, Jan-Feb 91
(manuscript received 13 Nov 88) pp 106-107

[Article by Ye.M. Levinskiy, V.I. Barmashenko, L.G. Dukhlenko, and D.A. Kuznetsov]

UDC 621.357.1.035.35:661.419

[Abstract] Ftorlon fabric, which is manufactured from fiber based on a copolymer of tetrafluoroethylene and vinylidene fluoride-fluoroplast-42 is a most promising material for manufacturing diaphragms for hydrochloric acid electrolyzers. Its chemical strength is much higher than that of the imported fabric made of heat-resistant polyvinyl chloride that is currently used. Tests of diaphragms made of two ftorlon fabrics (article Nos. 56072 and 56073) with different surface densities (136 and 233 g/m²) on a laboratory-model electrolyzer with a load up to 30 A demonstrated that the two were identically effective in separating electrolyzer products given the regulation pressure difference between chlorine and hydrogen (0.1 kPa). When the diaphragm made of No. 56072 ftorlon was used on a bench electrolyzer, however, the required separation of gases and hydrogen in the chlorine could only be achieved under nonlinear loads not exceeding 0.6 kA. The denser ftorlon fabric, i.e., No. 56073, was able to tolerate a load of 1 kA, however. The main drawback preventing the manufacture of diaphragms from ftorlon is that it is not wide enough; No. 56073 ftorlon is only 104 cm wide, and a width of 190 cm is required to make the diaphragms. Fabric of this width cannot be manufactured at the present time. Two diaphragms made of ftorlon have been successfully tested in a commercial electrolyzer for more than 20,000 hours. In 1985, a commercial electrolyzer (with 32 cells) outfitted entirely with ftorlon diaphragms was started up at the rated load of 9.3 kA. An examination of the electrolyzer after its planned 2-year run between scheduled repairs revealed that the diaphragms' technical indicators were still within the range of their regulation

norms and could be used further. The ftorlon diaphragms tested thus confirmed that using ftorlon to make diaphragms for use in hydrochloric acid electrolyzers helps extend their operating life and makes it possible to recover significantly larger amounts of acid than when conventional heat-resistant polyvinyl chloride diaphragms are used. Nos. 56073 and 22391/2 ftorlon were thus recommended for use in manufacturing such diaphragms. References 3 (Russian).

Selecting Versions of the Technology To Prepare Oil on Offshore Platforms

917M00701 Kiev *KHIMICHESKAYA
TEKHNologiya* in Russian No 2, Mar-Apr 91
(manuscript received) pp 19-24

[Article by A.A. Kandaurov, V.I. Sukhorukov, and M.M. Zarufullin, SakhalinNIPImorneft (not further identified), Okha]

UDC 622.279.3.04:658

[Abstract] Designing systems to prepare oil on offshore platforms entails selecting one or two suitable versions of the technology from among a set of alternatives. Such decisions are generally classified as follows: decision making under conditions of determinacy, decision making under conditions of risk, and decision making under conditions of indeterminacy. The difficulty of making decisions under conditions of determinacy lies in the fact that each of the alternatives may be the best from the standpoint of one optimality criterion but the worst from the standpoint of the others. The task of making a decision under conditions of risk is characterized by the fact that all possible outcomes of the decisions being made and the probability of their occurrence are known. In the case where decisions are made under conditions of indeterminacy, each of the possible decisions has its own set of outcomes; however, the probabilities of these outcomes are not known, and they have no meaning. Because methods of decision making under conditions of indeterminacy have not yet been adequately developed, the process of assessing and selecting from among complex systems is generally reduced to one of two tasks: decision making under conditions of determinacy or under conditions of risk. The authors of this article examine the problem of selecting a version of the technology to prepare oil on offshore platforms. They used the method of the preferred alternative because it does not require knowledge of the functional dependencies between particular criteria. The problem of selecting versions of preparing oil is solved by way of the example of the analysis of six process flows. The proposed method makes it possible to select versions of preparing oil on offshore platforms based on several of the most important general system efficiency criteria and several special efficiency criteria. With respect to the particular problem of selecting an oil preparation process flows, the authors conclude that a process flow

entailing hot separation and settling using a demulsifier is the best from a risk standpoint. Figures 4, tables 4; reference 1 (Russian).

Designing Ring Heads To Extrude Filled Polymers

917M0070B Kiev *KHIMICHESKAYA
TEKHNOLOGIYA* in Russian No 2, Mar-Apr 91
(manuscript received 5 Jul 90) pp 41-45

[Article by V.I. Mozyrskiy, S.B. Kotov, V.A. Kenatos, and V.V. Skachkov, Ukrainian Plastics Scientific Research and Design Institute, Kiev]

UDC 678.053.3

[Abstract] The authors of this article discuss the principles of the method of designing the distributing segments of ring extrusion heads to produce films of filled polymers whose flow may be described by an equation for nonlinear biharmonic liquids. They then proceed to present a method for doing so. The goal of the proposed design process is to determine the optimal geometry for the channels of a head that would provide the minimal difference in thickness along the sleeve perimeter of the polymer film, which is the main quality indicator for a finished filled polymer product. Equations are presented for use in determining the pressure gradient at selected points along the spiral disturbing channel, as well as the value of the pressure gradient in the ring channel and the depth of the ring channel at selected calculation points. The values obtained by the authors for the depths of the ring channel under consideration may be approximated by a conical or cylindrical mandrel surface. Figures 4; references 9; 5 Russian, 4 Western.

Technical and Economic Aspects of Using the Secondary Energy Resources of Gas Main Compressor Stations

917M0070E Kiev *KHIMICHESKAYA
TEKHNOLOGIYA* in Russian No 2, Mar-Apr 91
(manuscript received 11 Oct 90) pp 88-90

[Article by V.V. Kolesnik, I.L. Yurashchik, Yu.V. Yevdokimov, and V.O. Bannik, Gas Institute, UkSSR Academy of Sciences, Kiev]

UDC 628.4.002.8:662.7

[Abstract] Despite the ever-increasing consumption of natural resources, the efficiency with which these resources is used still remains extremely low (barely 5-10%). It is thus vital that we find new ways of using secondary energy resources to a greater extent and more efficiently. As far as the transport of gas through gas mains is concerned, there are two basic ways in which the efficiency of using energy sources can be increased. The first is to reduce the amount of secondary energy sources produced during the gas transport process and increase the efficiency of gas blowers by switching to improved technological processes. The second way is to recover and make greater use of the secondary energy resources that are produced. Making greater use of secondary energy resources not only conserves the primary energy source but also conserves the other natural resources needed to produce it. It also cuts down on the emissions of toxins into the atmosphere. Recovering the spent gases of gas turbine plants at compressor stations, for example, not only saves the costs of the equivalent primary energy source but also cuts down on the environmental damage caused by such harmful substances as dust, sulfurous anhydride and other sulfur oxides, nitrogen oxides, hydrogen fluoride and other fluoride compounds, hydrocarbons, and carbon monoxide. The recovered spent gases of the gas turbine plants of gas main compressor stations may be used in various ways. These include meeting the compressor stations internal power needs (secondary energy resources can be used to meet up to 90% of a compressor station's internal thermal power needs), selling the secondary energy resources for use at other industrial facilities, and using the secondary energy resources to supply heat to vegetable greenhouse complexes. The Gas Institute of the UkSSR Academy of Sciences has collaborated with the All-Union Gas Transport Scientific Research and Design Institute to develop methodological recommendations regarding calculating the material-and-heat balance of secondary energy resources and the economic effectiveness of using secondary energy resources. Specifically, these recommendations have been used to create a computer and software system that can be used to calculate the technical and economic indicators of a system to recover the heat of the exhaust gases of the gas turbine plants of gas main compressor stations. The system may be used by itself or may be included in an automated design (CAD) system. References 5 (Russian).

Maximum Explosion Pressure of Gaseous and Gas-Vapor Combustible Mixtures*917M0036F Moscow KHIMICHESKAYA**PROMYSHLENNOST in Russian No 11, Nov 90**pp 17-18 (657-658)*

[Article by S.F. Yevlanov]

UDC 614.833.4

[Abstract] Maximum explosion pressure (P_{\max}) is one of the most important indexes of fire-explosion hazards of the burning materials; it is the greatest pressure forming during inflammation of gas-, vapor- or dust-air mixtures. Although the P_{\max} can be determined experimentally,

the required equipment is complex and not available on all sites. There are several methods that can be used to calculate P_{\max} ; indeed, it was calculated for a number of frequently used combustible mixtures employing the relation of the density of starting combustible mixture to the density of the combustion products: $\rho=\rho_0$. Most of the calculated values were greater than the experimental ones. This probably is due to incomplete combustion of the particles. In spite of this discrepancy, the calculated values can be viewed as the upper limit of the realistically obtainable explosion pressures. Therefore, these values can be used in providing preliminary fire-explosion safety data for various technological processes. References: 9 (Russian, 2 by Western authors).

Production of a Catalyst for Conversion of Methane Using Basic Nickel Carbonate From Spent Electrolyte

917M0044A Kiev *KHIMICHESKAYA TEKhnOLOGIYA* in Russian No 6, Nov- Dec 90 (manuscript received 30 Mar 90) pp 11-14

[Article by A.A. Svetikov, V.A. Suvorin, A.D. Tereshchenko and V.V. Veselov]

UDC 66.097.3.004.8:621.3.035.34

[Abstract] Spent electrolytes from galvanic plants represent one source of starting materials for production of catalysts. A method was developed to obtain basic nickel carbonate by treating nickel plating sulfate electrolyte with a solution of sodium carbonate followed by repeated washing of the formed precipitate. This last step is required to prevent contamination of the local water table with nickel compounds. The basic nickel carbonate thus obtained can be used in production of catalysts for conversion of the natural gas. Because of the relatively small quantities of the electrolytes available on local plants, it was recommended that the catalyst production units be located on regional levels, in industrial centers. Economical gains resulting from this process have been calculated to reach four million rubles annually. Figure 1; references 10; 8 Russian, 2 Western

Properties of Zeolites Modified With Chlorosulfonated Polyethylene

917M0044B Kiev *KHIMICHESKAYA TEKhnOLOGIYA* in Russian No 6, Nov- Dec 90 (manuscript received 8 Oct 86) pp 17-18

[Article by A.N. Rassokha, V.L. Avramenko and L.I. Kirkach]

UDC 549.67:541.183

[Abstract] In an attempt to increase the effectiveness of zeolite, it was impregnated with chlorosulfonated polyethylene (CSPE). The effect of such adsorptive modification on its structural, mechanical, rheological and technological properties was investigated. Modification of synthetic and natural zeolites was carried out using 1.2 g/100 ml solution of CSPE in toluene, the process lasting 3 hrs at $20 \pm 2^\circ\text{C}$ with continuous rotation. Then the powder was filtered, dried (10-13 hrs at $40-50^\circ\text{C}$) and milled to the original consistency. This modification of the surface of zeolite changed a number of its characteristics: compactness, coefficient of volume filling, bulk weight, pH of the aqueous suspension and the hygroscopic properties. Synthetic zeolite adsorbs 2.8 times more CSPE on its surface in comparison to the natural material. This creates a possibility to regulate and optimize the properties of the fillers in manufacturing items made from such polymers. References: 6 (Russian).

Methodological Improvement of Production of $\text{Cu}_3(\text{PO}_4)_2 \cdot 3\text{H}_2\text{O}$

917M0044C Kiev *KHIMICHESKAYA TEKhnOLOGIYA* in Russian No 6, Nov- Dec 90 pp 19-21

[Article by L.V. Voytenko and V.A. Kopilevich]

UDC 661.635.53

[Abstract] Conditions required for production of $\text{Cu}_3(\text{PO}_4)_2 \cdot 3\text{H}_2\text{O}$ were studied in an attempt to increase the yield and purity of the final product. The following method appeared to give satisfactory results: calculated amounts of distilled water and 89.8% phosphoric acid were placed in the reactor, heated to the required temperature and a freshly prepared copper hydroxycarbonate was added in increments with constant stirring. The precipitate was filtered, washed and dried at 313 K. Temperature was a very crucial factor in this reaction; it should be maintained at 323 K. The yield of the final product was 97.8%. References 8; 7 Russian, 1 Western.

The Mechanism of the Dissolution of Copper in the Presence of Catalytically Active Complexes of Copper (II)

917M0068C Kiev *UKRAINSKIY KHIMICHESKIY ZHURNAL* in Russian Vol 57 No 2, Feb 91 (manuscript received 10 May 90) pp 146-156

[Article by V.I. Larin, E.B. Khobotova, and S.D. Gorobets, Chemistry Scientific Research Institute, Kharkov University]

UDC 621.794.42.546.56

[Abstract] The technique of etching copper with solutions of chlorides of copper (II) and iron (III) is widely used in the production of printed circuit boards. The mechanism of this process has yet to be explained in a satisfactory manner, however. For this reason, the authors of this review have summarized the literature and experimental data on the ionization of copper in solutions of salts of copper (II) in the presence of chloride ions and ammonium. The interconnection between the mechanism of copper dissolution and (1) the form of in which the complex particles exist in the solution and (2) the change in the rate constants of electron exchange between the oxidized and reduced forms of metal ions as a function of the presence of electron donor and electron acceptor groups in them and the number of like ligands is demonstrated. A form of copper (II) complexes that have catalytic activity in acid chloride and ammonium solutions is established, and a multistage scheme of the ionization of copper in an acid chloride solution is proposed. The authors conclude that the existing literature on the mechanism of the ionization of copper does not adequately address a number of aspects of the topic and does not present a unified view

on others. They further conclude that while most of the available works address the problems of the electrochemical kinetics and stoichiometry of the ionization of copper, far less attention has been paid to the catalytic nature of the reaction, the dependence of the process kinetics on the nature of the oxidizing agent in the

solution, and the effect of the complexing of ions of copper (II) with different anions on the reaction mechanism. They therefore call for further research on the mechanism of the ionization of copper in chloride-containing solutions. Table 1; references 70: 44 Russian, 26 Western.

Primary Purification of Industrial Sewage From Aniline Dye Industrial Plants

917M0036E Moscow *KHIMICHESKAYA PROMYSHLENNOST' in Russian* No 11, Nov 90 pp 15-17 (655-657)

[Article by N.P. Gendruseva, V.A. Livke, V.I. Ostrovka and T.V. Seninets]

UDC 628.543.661.7

[Abstract] Biological purification of chemical industry sewage is one of the most effective available methods. To achieve normal functioning of the microorganisms involved in this process, the medium should be neutral, and toxic substances should be absent along with film forming reagents. Industrial sewage from aniline production varies widely in its composition of organic impurities. Prior to biological purification, it must be pretreated to remove some of the contaminants. The pretreatment consists of neutralization, coagulation, flotation, sorption aeration, filtration, sedimentation, centrifugation steps etc. A purification method was described which includes neutralization of the industrial sewage, mixing with excess active sludge, a two stage neutralization with suspension of lime, sedimentation and clarification of the effluent, concentration of the condensed precipitate and filtration. After this preliminary purification, the sewage is treated with biological reagents. Figure 1; references: 9 (Russian).

A Method for Exerting Remote Effects on the Spatial Distribution of Aerosol Pollutants

917M0070C Kiev *KHIMICHESKAYA TEKHNLOGIYA in Russian* No 2, Mar-Apr 91 (manuscript received 5 Jul 90) pp 80-84

[Article by I.F. Binko]

UDC 541.18.551.501

[Abstract] Because of the continued worsening of the ecological situation, ever-increasing attention is being paid to the problems of remote investigation of aerosol emissions from industrial enterprises. A number of big industrial disasters caused by emissions of aerosol-type chemical compounds into the air basin have illustrated the need to create not only effective methods for sampling and quantitative assessment of pollutants but also methods for remote suppression of such disperse aerosol formations. This article proposes a method for suppressing aerosol atmospheric pollutants by enterprises in the chemical industry. The method is based on the remote introduction of electromagnetic or electrostatic fields. This type of action results in a change in the molecular and kinetic properties of dispersion aerosol emissions: it intensifies the processes of particle coagulation and sedimentation. Analytical expressions are derived that describe the process of the effect that introducing such fields has on the spatial distribution of

aerosol formations. The effectiveness of the proposed method is demonstrated by a mathematical model. The model presented assumes an aerosol particle size of 10^{-1} to 10^2 μm , a particle charge of 10^{-10} coulombs, an electromagnetic field intensity of 1,000 A/m, and an electromagnetic wave frequency of 10^3 - 10^{10} Hz. Figures 3; references 4 (Russian).

A Method of Estimating Gross Emissions of Toxins From the Surfaces of Open Structures

917M0070D Kiev *KHIMICHESKAYA TEKHNLOGIYA in Russian* No 2, Mar-Apr 91 (manuscript received 13 Feb 89) pp 85-87

[Article by T.M. Tokarev, V.I. Smirnov, and L.M. Rabinovich, SintezPAV (Surfactant Synthesis) Scientific Production Association, Volgogradsk]

UDC 62-784.23

[Abstract] The emissions formed when toxic substances evaporate from the surface of open structures have a significant effect on pollution of the atmosphere near enterprises. These open structures may include biologic sewage treatment systems (settling tanks, preaerators, air tanks), the open surfaces of slime and sludge sites, and repurification ponds. Before an objective estimate of the amount of wastes released from the surfaces of open structures can be made, it is necessary to develop a correct method of determining the gross emissions of toxins into the atmosphere. The existing method of calculating gross emissions from ground sources is not reliable enough because it does not contain any allowances for the key meteorological parameters (such as wind speed and temperature). This article outlines a new method that has been developed to determine the amount of hydrocarbons blown from the surfaces of open structures. Unlike its predecessor, the new method does consider all of the meteorological factors and geometric parameters that affect the amount of emissions from open evaporation surfaces. According to the new method, gas specimens are sampled simultaneously by syringes in reference planes of the windward and leeward sides. The syringes are moved evenly along the projections of reference planes in horizontal and vertical directions. The gas-and-air balance is determined at actual wind velocities from 2 to 7 m/s. A formula is provided for use in determining the amount of toxins emitted into the atmosphere (in g/s). Using a sorption device with liquid and solid sorbents and aspiration instruments to take specimens will make it possible to use a stationary sampling method (the sampling device may be secured in a fixed position). A technique that makes it possible to calculate the distribution of the test substance in each cubic meter of the reference plane can then be used. This is done by taking air samples at heights of 6.3 and 0 meters and then determining the average concentrations of an average sample of the air being studied. The height at which the average sample is

located is determined by calculating the average concentrations on the basis of distribution curves. The sampling height of average air from both the windward and leeward sides of the test object must be determined separately for each specific substance and for the given

meteorological conditions. The use of the proposed method is illustrated by way of the example of a computation of the gross emissions of toxins from the open structures at the Volgodonsk Chemical Plant. Figures 2, table 1.

Technology of Complex Fertilizers Containing Microelements

917M0036G Moscow *KHIMICHESKAYA PROMYSHLENNOST* in Russian No 11, Nov 90 pp 19-21 (659-661)

[Article by I.M. Kuvshinnikov, A.Ye. Tavrovskaya and M.P. Komarov]

UDC 631.812:66.017

[Abstract] Preparation of complex NPK fertilizers containing microelements is a complex problem. In some cases, during formation of the crystalline mass, some salt systems convert to a hygroscopic viscous mass which cannot be granulated. On the other hand, co-crystallization of microelements results in improved properties, easy granulation and excellent storage of the final product. In general, the catalytic effect of microelements is directly related to the way in which the microelements are incorporated in the crystalline structure. Experimental results were reported of a comparative analysis of addition of microelements to the fertilizers using the 17:17:17 nitroammophoska as an example. It was shown that the most effective method for production of complex fertilizers containing microelements is based on granulation of the mixture of nutritional components in an AG apparatus and then adding the microelements in form of an aqueous solution. This stimulates the granulation process and improves the physical properties of these fertilizers. The product shows maximum thermal stability. Due to the fact that decomposition of nitroammophoska occurs at only 20° above its melting point, the addition of microelements

must be done very carefully; addition of copper compounds is contraindicated. Figures 3; references: 3 (Russian).

Fire Danger of Mixed Complex Fertilizers

917M0036H Moscow *KHIMICHESKAYA PROMYSHLENNOST* in Russian No 11, Nov 90 pp 27-29 (667-669)

[Article by L.K. Meshalkina]

UDC 614.841.411:631.85

[Abstract] Mixed complex fertilizers have the tendency to heat up spontaneously resulting in a rapid decomposition, evolution of heat and heavy smoke containing various toxic substances, nitrous oxides, fluorine and chlorine compounds, etc. In the present paper, detailed results were reported of the investigation of complex mixed fertilizers with a tendency to self-induced combustion. The characteristic property of this type of cigar-like combustion is the evolution of white smoke and development of heat reaching 400-500°C. The fertilizers decompose with an autocatalytic acceleration. These chemicals contain enough oxidized and combustible elements so that they need no air oxygen for their decomposition. After it is over, the residue retains its granular form but is completely baked, with a hard shell on the granular surface. The following fertilizers were analyzed and their properties reported in detail: NPK=17-17-15; NPK= 16-18-16, 0.17% B; NPK= 14-19-19, 0.03% Mg; NPK= 15-17-18, 0.21% Co; NPK= 11-11-11; NPK= 10-11-11 and NPK= 10-11-11, 8% lignin. References: 3 (Russian).

Performance Analysis of Gas Refrigerators E-101 in Production of Ammonia Using AM-600 Equipment and Measures Designed to Extend Their Operational Time

917M0044F Kiev KHIMICHESKAYA
TEKHNLOGIYA in Russian No 6, Nov-Dec 90
(manuscript received 5 Mar 90) pp 75-78

[Article by Yu.A. Vakhrushev, N.I. Korchaka, V.P. Fridrikh, A.A. Plysyuk and T.M. Mozhushina, Cherkassy Production Organization "Azot"]

UDC 662.76.62-71

[Abstract] Five ammonium units with a production capacity of 200,000 t/year are operational at the Cherkassy Production Organization "Azot". Canadian-made gas refrigerators are used on all of them. Their trouble-free performance lasted less than 2 years often leading to breakdown of the piping. In the present paper analysis of possible reasons for this poor performance was given. The following trouble spots were identified: the pipes in the refrigerators were made of improper material, poor choice was made of the catalyst used in methane conversion process, absence of proper filtration of the condensate and inadequate technological discipline of the servicing personnel. The following solutions were suggested for the above problems: the pipes should be made of a material capable of withstanding higher temperatures; the catalyst should contain minimal levels of silicone; the filtration system of the condensate had to be improved and the servicing personnel had to become more attentive.

Quantum Chemical Study of the Reaction of Carbon Dioxide With Melted Halides of Alkaline Metals

917M0068A Kiev UKRAINSKIY KHIMICHESKIY
ZHURNAL in Russian Vol 57 No 2, Feb 91
(manuscript received 14 Nov 89) pp 115-119

[Article by V.V. Solovyev, Kh.B. Kushkhov, V.I. Shapoval, K.S. Bakhtybekov, and V.N. Stadnikov, Poltava Construction Engineering Institute and Institute of General and Inorganic Chemistry, UkSSR Academy of Sciences, Kiev]

UDC 541.57.138

[Abstract] This article reports a quantum chemical study of the reaction of carbon dioxide molecules with cations and anions of melts at the electron level. Specifically, Na^+ and Li^+ cations and Cl^- and F^- anions were selected for study. The study computations were based on the method of the self-consistent field theory of molecular orbitals in a linear combination of atomic orbitals. The geometric structures of all of the reactions studied were optimized by changing the length of the $\text{C-A}(\text{Cl}, \text{F})$ and $\text{O-K}^+(\text{Na}^+, \text{Li}^+)$ bonds and finding the minimum of the total energy of the object corresponding to the maximum

reaction. The bond energies were calculated by the fragment-by-fragment method as described elsewhere. Calculations were made with the cations and anions considered separately and together. The bond energy in the CO_2 molecule was found to decrease significantly (by a factor of 1.6 to 1.8) in the presence of both Na^+ and Li^+ cations and Cl^- and F^- anions when compared with the bond energies in an isolated CO_2 molecule. A combined cation-anion effect was found to result in a softer weakening (by a factor of 1.2 to 1.4) of the intramolecular C-O bonds than in the case of the separate effect of either. Together with data from electrochemical measurements that have been published elsewhere, the quantum chemical study reported made it possible to hypothesize that the reaction of carbon dioxide with the cations and anions of the solvent results in the formation of molecule-ion associates of the type $2\text{K}^+ \cdot \text{CO}_2 \cdot 2\text{A}^-$. This in turn increases the solubility of CO_2 in halide melts when compared with the solubility of noble gases, for which only "physical" introduction of molecules into the liquid phase is realized. Figures 2, tables 4; references 7; 5 Russian, 2 Western.

The Complexing of Silver Nitrate With Heterocyclic and Aliphatic Amines

917M0068B Kiev UKRAINSKIY KHIMICHESKIY
ZHURNAL in Russian Vol 57 No 2, Feb 91
(manuscript received 3 Jul 89) pp 124-127

[Article by V.P. Shram and N.R. Molchanova, Dnepropetrovsk Chemical Technology Institute]

UDC 543.244.6:543.243

[Abstract] The study reported herein examined the complexing of silver (I) nitrate with heterocyclic amines, the formation of complexes in dimethyl sulfoxide [DMSO], and the nature of the chemical bond between a silver (I) ion and amine. Analytic reagent-quality silver (I) nitrate was used for the studies. The DMSO and amines were purified in accordance with the method described elsewhere, and their purity was determined on the basis of their boiling or melting temperatures. Their complexing was studied by the potentiometric method with an EV-74 ionmeter. The makeup and stability constants of complexes of silver (I) ions with pyridine, its substituents, piperidine, n-butylamine, isoamine, and tert-butylamine in DMSO were determined at a temperature of $20 \pm 1 - 2^\circ\text{C}$. The correlation equations characterizing the dependence of the complexes' stability on the relative strength of the ligand bases were calculated. A dual metal-ligand bond was established: σ -donor and π -donative reactions between the silver ions and ligands having an aromatic ring. The characteristics of the π -donative reaction were calculated. The π -donative reaction in complexes of silver (I) was found to decrease as the strength of the ligand bases increased. An analogous law has been observed during the complexing of copper (I), copper

(II), chromium (III), nickel (II), and nitrates of certain other d-elements with pyridine and its derivatives. The characteristics of the π -donative reaction that occurs during the formation of silver (I), which is a d-metal of the

second transition series, were found to have higher values than did those for complexes of d-metals of the first transition series. Tables 2; references 7, 6 Russian, 1 Western.

Plasma Chemical Synthesis of Highly Dispersed $\text{YBa}_2\text{Cu}_3\text{O}_x$ Powders

917M0049A Riga IZVESTIYA AKADEMII NAUK LATVIYSKOY SSR SERIYA KHIMICHESKAYA
in Russian No 6, Dec 90 (manuscript received
26 Mar 90) pp 643-648

[Article by A. A. Kuzyukevich, Ya. K. Vayvads, Ya. P. Grabis, and I. F. Shteyns, Institute of Inorganic Chemistry, LaSSR Academy of Sciences]

UDC 621.762

[Abstract] Results are presented from a study of the synthesis of highly dispersed $\text{YBa}_2\text{Cu}_3\text{O}_x$ powders in the low-temperature plasma of an RF discharge on a laboratory installation in a medium of nitrogen plus oxygen or air. The composition of the synthesis products was determined by neutron-activation analysis, the phase composition by x-ray studies. Plasma chemical synthesis succeeded in producing powders with specific surfaces of about 20 square meters per gram. The basic phase was $\text{YBa}_2\text{Cu}_3\text{O}_x$ with a tetragonal T' structure. Production of the superconducting O structure requires additional heat treatment at 870°C, which results in the formation of a high-temperature superconductor with a critical point of about 100 K and particle diameter about 0.5 μm , based on specific surface. Production of highly dispersed high-temperature superconducting powders requires optimization of the heat treatment process under conditions to eliminate or essentially inhibit sintering and recrystallization processes. Figures 4; References 24; 8 Russian, 16 Western.

Finely Dispersed Composite Powders Based on Aluminum and Zirconium Oxides

917M0049B Riga IZVESTIYA AKADEMII NAUK LATVIYSKOY SSR SERIYA KHIMICHESKAYA
in Russian No 6, Dec 90 (manuscript received
16 Mar 90) pp 648-652

[Article by Ya. P. Grabis, A. B. Letlenai, and I. P. Ubele, Institute of Inorganic Chemistry, LaSSR Academy of Sciences]

UDC 666.762

[Abstract] A study is made of the characteristics of finely dispersed powders in the system $\text{Al}_2\text{O}_3\text{-ZrO}_2\text{-(Y}_2\text{O}_3)$, obtained by evaporating powders of aluminum and oxygen-containing compounds of aluminum, zirconium, and yttrium in a high-temperature gas jet. The apparatus included a high-frequency plasmotron, chamber for input and mixing of substances, reactor, heat exchanger, and filter to trap the reaction products. The specific surface of the powders produced was determined chromatographically based on the thermal desorption of argon, and the particle sizes and shapes were determined on an electron microscope. The phase composition of the powders was studied by x-ray analysis, and the content of

the tetragonal modification of zirconium dioxide was computed by the equation of Garni and Nicholson. The specific surface of the powders produced was 20-50 m^2/g . Heating to 750-1350°C increases the particle size and changes the phase composition of the powders, the presence of aluminum oxide limiting the formation of the monoclinic modification of ZrO_2 , while zirconium dioxide decreases the temperature at which $\alpha\text{-Al}_2\text{O}_3$ is formed. Figures 5; References 7; 2 Russian, 5 Western.

Glass Formation in System $\text{Li}_2\text{O-P}_2\text{O}_5\text{-LiPN}_2$

917M0050 C Riga IZVESTIYA AKADEMII NAUK LATVIYSKOY SSR SERIYA KHIMICHESKAYA
in Russian No 6, Dec 90 pp 665-672

[Article by M. A. Vayvada, Z. A. Konstant, A. A. Vitola, T. N. Miller, Institute of Inorganic Chemistry, LaSSR Academy of Sciences]

UDC 539.213.546.94'18'21'17

[Abstract] A study is made of the possibility of synthesizing oxynitride glasses by adding lithium-phosphorus nitride LiPN_2 to lithium-phosphate glasses. Due to the similarity of the basic structural units of these substances [(PO_4) and (PN_4) tetrahedrons], it can be assumed that redistribution of the oxygen and nitrogen atoms occurs upon reaction of the substances, forming a mixed network of $[\text{P}(\text{N}, \text{O})_4]$ tetrahedrons. Charges were prepared by careful mixing of powders of the nitride and the initial glass. Glasses were synthesized at 750-800°C in an electric furnace with carborundum heaters in an atmosphere of nitrogen in corundum crucibles. The time at maximum temperature was 1 hour. The content of nitrogen in the oxynitride glasses was determined by the method of Kjeldal. The products of crystallization were studied by x-ray diffraction and IR absorption. The index of refraction of the glass was determined by the method of immersion fluids. The phosphoroxynitride glasses had a mass content of N of up to 7.9%. The thermal reactions of the components of the initial mixtures were studied at 20-700°C. Introduction of nitrogen reduces the crystallization capacity and improves the properties of the P-O-N glasses in comparison to the initial phosphate glasses at all $\text{Li}_2\text{O/P}_2\text{O}_5$ ratios. Figures 5; References 19; 3 Russian, 16 Western.

High-Temperature Oxidation of PT-7M Titanium Alloy in Air

917M0050A Leningrad ZHURNAL PRIKLADNOY KHIMII in Russian Vol 63 No 10, Oct 90 (manuscript received 16 Mar 90) pp 2156-2162

[Article by V. I. Dyachkov, Leningrad State University]

UDC 620.193.5.669.2'5.5

[Abstract] A study is made of the oxidation of PT-7M α -titanium alloy (containing about 2% Al, 2.5% Zr) in air at 1073-1473 K in order to establish the kinetic features

of the process, the temperature dependence of the rate constant, the distribution of oxygen among the solid phases, the composition and structure of the scale formed, and the significance of diffusion of the reacting components for scale formation. It was found that the kinetics of oxidation under these conditions can be described by the Evans equation, indicating that the process is an unsteady one. Growth of an oxygen diffusion layer at 1273 K differs significantly from the parabolic rule formed by the process of scale formation. The temperature variation of the parabolic oxidation rate constant for the alloy shows a decrease in slope as the area above 1123 K is entered. The oxidation activation energy was found to be about 159 kJ/mol by the linear rule, 386 (below 1123 K) and 150 (above 1123 K) kJ/mol per the parabolic rule. Oxidation of PT-7M alloy occurs more slowly than that of pure titanium, with an expanded temperature limit of applicability of the Evans equation, a change in the specifics of scale growth and oxygen diffusion layer growth, and a temperature variation of the linear rate constant with a significant variation in linear energy, particularly below 1173 K. This decrease in the rate of oxidation for the alloy results from a decrease in the oxide film growth rate. Figures 5; References 8; Russian.

Oxidation of Titanium and Its Alloys in the Nonsteady (Transition) Areas

917M0050B Leningrad ZHURNAL PRIKLADNOY KHIMII in Russian Vol 63 No 10, Oct 90 (manuscript received 16 Mar 90) pp 2162-2169

[Article by V.I. Dyachkov, Leningrad State University]

UDC 620.193.5.669.295

[Abstract] In many cases the data published in the literature on the oxidation of titanium are unreliable and even erroneous. This is particularly true of the concept of parabolic kinetics of titanium oxidation at temperatures over 800°. Based on previously published studies and earlier works by the author, a table is presented indicating the applicability of the Evans equation for oxidation of titanium and its alloys. In many cases, starting at a certain temperature, the Evans equation practically fully controls the process of oxidation over a long period of time. The Evans equation is valuable in that it allows a description of the process of oxidation in the unsteady or transition area. The importance of the Evans equation is also manifested in that, since it indicates nonequilibrium oxidation conditions at one or more of the boundaries of the scale, it explains the reasons that only a small part of the state diagram of the Ti-O equilibrium system is applicable. New equations are derived to describe the process of oxidation of the metal in the unsteady area, complicated by the growth of the diffusion layer of oxygen. These equations allow qualitative prediction of the influence of oxygen pressure in the gas phase and its content in the initial specimen on the coefficients of the Evans equation and the ratio of the content of oxygen in

the diffusion layer and in the scale. Figures 2; References 39; 17 Russian, 22 Western.

Influence of Ligands in Copper (II) Complexes on Copper Dissolution Rate in Ammonia Solutions of Its Salts

917M0050C Leningrad ZHURNAL PRIKLADNOY KHIMII in Russian Vol 63 No 10, Oct 90 (manuscript received 9 Jun 89) pp 2181-2185

[Article by V.I. Larin, E.B. Khobotova, V.V. Datsenko]

UDC 621.794.42.546.56

[Abstract] A projection method was used to determine the equilibrium ion concentrations in the ionization of copper in ammonia solutions of its salts. The rate of ionization of copper was determined gravimetrically on a rotating disk electrode made of type M-99 copper. It is found that the particles determining the rate of copper ionization are hydroxo complexes, which cause the rate to decrease rapidly, and $[\text{Cu}(\text{NH}_3)_4(\text{H}_2\text{O})_2]^{2+}$ complexes, which have a catalytic influence. Based on this, formulas are presented for the dissolution of copper in concentrated solutions of CuCl_2 , NH_4Cl , and NH_3 . Figures 4; References 14; 13 Russian, 1 Western.

Electron Microscope and Electronographic Study of the Influence of Polymer Organic Binders on the Formation of Corundum Ceramic

917M0050D Leningrad ZHURNAL PRIKLADNOY KHIMII in Russian Vol 63 No 10, Oct 90 (manuscript received 18 Apr 90) pp 2365-2367

[Article by M.G. Degen, L.V. Filina, I.A. Drozdova, N.A. Komkov, A.I. Frantsev, Institute of Silicate Chemistry, USSR Academy of Sciences]

UDC 621.612.8:620.187

[Abstract] A study was made of compositions containing 80 mass percent Al_2O_3 and 20 mass percent phenol-formaldehyde binder of two types, both of which formed three-dimensional oligomers similar to phenol-formaldehyde resins, one of novolak type, the other of resol type. Morphologic studies of the materials were performed on an electron microscope by transmission. It was found that the structure of the phenol-formaldehyde oligomer does make a difference in the formation of the ceramic. In the resol composition the new crystalline phase $\text{Al}_4\text{O}_4\text{C}$ was formed, while in the novolak composition no structural changes were observed in the boundary area of the Al_2O_3 particles. It was found that only microdiffraction can reveal the effect of carbon with a content of less than one percent, formed as a result of thermal destruction of the oligomer binder. Figure 1; References 4; 2 Russian, 2 Western.

Study of Alloy Formation in Electrodeposition of Hafnium From Melt Onto Steel and Graphite Substrates

917M0050L Leningrad ZHURNAL PRIKLADNOY KHMII in Russian Vol 63 No 10, Oct 90 (manuscript received 2 feb 90) pp 2374-2377

[Article by S.V. Kuznetsova, A.L. Glagolevskaya, and S.A. Kuznetsov, Institute of Chemistry and Technology of Rare Metals and Mineral Raw Materials, Kola Science Center, USSR Academy of Sciences]

UDC 541.135.6

[Abstract] A study is made of alloy formation upon electrodeposition of hafnium onto substrates of steel of type St3, U10 and cathodes of spectrally pure graphite and SU-2000 carbon-reinforced glass. The melt used was an equimolar NaCl-KCl mixture containing 10 mass percent K_2HfF_6 and 5 mass percent NaF. Cathode chronopotentiograms were measured at 973-1123 K with current density $3\cdot5\cdot10^{-1}$ A/cm² until the potential difference between the cathode and hafnium comparison electrode disappeared. The studies showed that a barrier layer of hafnium carbide was formed between the hafnium and the St3 steel substrate, and this prevented mutual diffusion. Figures 4; References 10: 8 Russian, 2 Western.

Superconductivity in System $Ca_{0.5}La_{0.5}Ba_{1+x}La_{1-x}Cu_3O_x$

917M0060A Moscow ZHURNAL NEORGANICHESKOY KHMII in Russian Vol 35 No 12, Dec 1990 pp 3005-3007

[Article by V.P. Sirotinkin, O.I. Eshchinyazov, D.R. Tursunova, A.A. Yevdokimov, P.A. Arsenyev]

UDC 537.312.62

[Abstract] A study is made to determine the possible area of homogeneity of the superconducting phase near the composition $Ca_{0.5}La_{0.5}Ba_{1+x}La_{1-x}Cu_3O_x$, and to determine the influence of processing of synthesized specimens on their superconducting properties. Specimens were produced by solid-phase synthesis and the variation of resistivity with temperature was measured by the standard four-probe method. It is found that solid solutions of $Ca_{0.5}La_{0.5}Ba_{1+x}La_{1-x}Cu_3O_x$ exist for $0 \leq x \leq 0.4$ and that the transition point to the superconducting state of specimens close to $Ca_{0.5}La_{0.5}Ba_{1.25}La_{0.75}Cu_3O_x$ depends on the time and temperature of annealing at the oxygen point, the highest temperature resulting from longer annealing at lower temperature. Figure 1; References 4; Western.

Limitations on Production of A^3B^5 Solid Solutions

917M0060B Moscow ZHURNAL NEORGANICHESKOY KHMII in Russian Vol 35 No 12, Dec 1990 pp 3008-3012

[Article by A.N. Baranov, B.Ye. Dzhurtanov, A.M. Litvak, N.A. Charykov, A.G. Chernyavskiy, V.V. Sherstnev, Yu.P. Yakovlev, Leningrad Institute of Physics and Engineering imeni A.F. Ioffe, USSR Academy of Sciences]

UDC 621.315.592

[Abstract] The purpose of this work was to determine the compositions of semiconducting A^3B^5 solid solutions by liquid-phase epitaxy and the conditions of their synthesis. There are two independent limitations on the production of these solid solutions. 1. The limitation of spinodal decomposition at the temperature of epitaxy. The area of instability for spinodal decomposition expands with decreasing temperature. 2. The limitation of molecularity which follows from the condition of phase equilibrium between the melt and solid solution. The area of this limitation becomes narrower with decreasing temperature, degenerating to a point at the melting point of the lowest-melting compound forming the solid solution. Figures 6; References 2; Russian.

NMR Study of Structure and Anion Transport of Hardened Superionic Conductor PbF_2

917M0060C Moscow ZHURNAL NEORGANICHESKOY KHMII in Russian Vol 35 No 12, Dec 1990 pp 3013-3017

[Article by S.G. Bakhvalov, V.M. Buznik, V.A. Vopilov, I.S. Kernasyuk, A.N. Matsulev, Institute of Chemistry and Chemical Technology, Siberian Division, USSR Academy of Sciences; Krasnoyarsk State University]

UDC 549.461.1:54.143

[Abstract] The method of ^{19}F NMR was used to study the structural peculiarities of anion transport of specimens obtained by rapid quenching of melted PbF_2 . Lead fluoride was selected because of its simple composition and relatively low melting point. Specimens were quenched by catapulting the melt onto a copper drum spinning at 14,000 rpm and cooled to liquid nitrogen temperature, achieving a cooling rate of 10^5 - 10^6 /s. The rapid cooling produces x-ray amorphous specimens. Mathematical modeling of the low-resolution spectrum establishes that there are two components of different width, intensity and with different chemical shifts. Figures 3; References 13: 8 Russian, 5 Western.

Promising Herbicides Based on Sulfonyleureas

917M0036A Moscow *KHIMICHESKAYA
PROMYSHLENNOST' in Russian* No 11, Nov 90
pp 3-9 (643-649)

[Article by N.N. Melnikov and N.I. Aronova]

UDC 632.954(047)

[Abstract] Herbicides containing the sulfonyleurea grouping are used against a wide spectrum of weeds on a variety of grain fields and for protection of flax plants. Annual consumption of these herbicides is at the level of 200-300 million dollars. They suppress the wide leaf

weeds and a number of grassy weeds. Their mechanism of action is based on the inhibition of acetolactatesynthetase enzyme. This paper presents a detail review of synthetic methods published in foreign literature. Several thousand derivatives of sulfoureas have been synthesized. It is not expected that a totally novel sulfourea may be still discovered. Most of the efforts to improve their herbicidal activity will be oriented on a combination with other herbicides: triazine, triazol, ureas, diphenyl ethers, carbamate, dipyridyl etc. taking advantage of synergistic action of these combinations. Some of the examples of this trend include: canony, finesse, gemini etc. References 106: 91 Russian (87 by Western authors), 15 Western.

Use of Basic Sulfide Pyrolysis By-Products for Removal of Heavy Metals From Waste Water

917M0015A Moscow *KHIMIYA I TEKHOLOGIYA TOPLIV I MASEL* in Russian No 10, Oct 90 pp 5-6

[Article by Yu.R. Abdrahimov, Ufa Petroleum Institute]

UDC 661.715.332

[Abstract] The use of concentrated basic sulfide by-products from the pyrolysis of benzene to remove heavy metals from industrial waste water was investigated. Samples of waste water were neutralized from a pH level of 2.2 to a pH level of 9.4 with sodium hydroxide, after which they were treated with 0.01-0.1 mass% by-product solution, aluminum sulfate, and polyacrylamide. The greatest effect was obtained with 0.05 mass% by-product, which reduced Hg levels from 0.74 mg/L to 0.006 mg/L, Pb levels from 4.3 mg/L to 0.05 mg/L, and Zn levels from 1.5 mg/L to 0.04 mg/L. Both Cu and Fe^{3+} , originally at 0.8 mg/L and 20 mg/L respectively, were reduced below their limits of detection. Use of greater amounts of by-product gave lesser results, probably due to solubilization of metal complexes. The results obtained indicate that basic sulfide by-product solutions can offer both ecological and economic advantages when used in the purification of waste generated by galvanic and etching processes, as well as by the catalyst industry. References 2. Russian.

Evaluation of Sorbent Activity for Oil Regeneration

917M0015A Moscow *KHIMIYA I TEKHOLOGIYA TOPLIV I MASEL* in Russian No 10, Oct 90 pp 6-8

[Article by A.Yu. Yevdokimov, Yu.A. Eltekov, M.I. Falkovich, and I.I. Martyn, Moscow Institute of Petroleum and Gas imeni I.M. Gubkin, Institute of Physical Chemistry, USSR Academy of Sciences; Division of Natural Dispersed Systems, Physical Chemistry Institute, UkSSR Academy of Sciences]

UDC 665.765-404.004.86

[Abstract] Comparatively simple criteria for comparing the adsorption activity of various sorbents with respect to the purification of aged petroleum oil were developed. Experiments were conducted at 70°C for maximum reduction of viscosity without thermocatalytic decomposition. Askanite clay was found to have a greater adsorption capacity than bentonite or synthetic silica gel sorbent. An activity parameter was defined in terms of sorbent density, percolation velocity, sorbent mass, and the length of time the sorbent could be used to produce oil of the desired quality, as measured by optical density at 540 nm. When the parameter was determined for half the useful lifetime of the sorbent, the result for silica gel exceeded that for askanite. This indicates that silica gel is useful in the preliminary purification stage. The activity

parameter did not correlate with total pore volume. Figures 2; references 8; 7 Russian, 1 Western.

Production of Low-Solidification-Temperature Middle-Distillation-Cut Fuels From Low-Sulfur Paraffin-Based Petroleum

917M0015C Moscow *KHIMIYA I TEKHOLOGIYA TOPLIV I MASEL* in Russian No 10, Oct 90 pp 8-9

[Article by Zh.I. Gasanova, S.A. Sultanov, B.K. Nefedkv, B.S. Khydyrov, S.A. Samedova, and S.G. Musayeva, Institute of the Petrochemical Industry imeni Yu.G. Mamedaliyev, AzSSR Academy of Sciences; All-Union Scientific Research Institute of the Petroleum Industry]

UDC 665.753.2:665.654.2

[Abstract] Further processing of the fuel fraction obtained from the distillation of paraffin-based low-sulfur Azerbaijan petroleum is necessary in order to improve its low-temperature performance. A comparison of three methods for this processing, high-silica zeolite catalytic deparaffinization, carbamide deparaffinization, and selective cracking, was conducted to determine product quality and economy. Hydrogenation was necessary after the second and third methods in order to remove aromatic hydrocarbons. The carbamide process gave product that met all requirements for aviation fuel except density. The cracking process gave product that met all requirements and was 7 rubles and 77 kopeks less expensive per ton than the carbamide process. Selective cracking is recommended for improving the low-temperature performance of aviation fuel. References 3; 2 Russian, 1 Western.

Kinetics of Catalytic Cracking of Heavy Distillate Stock

917M0015D Moscow *KHIMIYA I TEKHOLOGIYA TOPLIV I MASEL* in Russian No 10, Oct 90, pp 11-13

[Article by N.N. Samoylova, V.N. Yarkin, and P.Yu. Serikov, All-Union Scientific Research Institute of the Petroleum Industry]

UDC 665.644.2.001.1

[Abstract] Basic kinetic equations were used to construct a mathematical model describing the catalytic cracking of petroleum raw materials. The model permitted plotting of a function of mass fraction of unreacted raw material remaining as a function of time. A family of straight lines was obtained for different materials reacted with the same catalyst. The total initial reaction rate was determined by extrapolation to zero time. The deactivation constant was found to be 21 hr⁻¹ at 420°C and 23 hr⁻¹ at 530°C, which indicates that it is essentially

constant over this temperature range. At 480°C paraffinic gas oil gave the highest rate constant, while aromatic gas oil gave the lowest constant, and an intermediate value was observed for naphthenic gas oil. A comparison of the calculated values for the degree of conversion with experimental observations for a mass rate of 6 kg/(kg x hr) showed good correspondence. Apparent activation energies obtained were 24.7-28 kJ/mol, which are not characteristic of a cracking reaction that proceeds in the kinetic domain. This indicates that the reaction is complicated by diffusion inhibition. Figures 3; references 11: 6 Russian, 5 Western.

Increasing Liquified Gas Quality for Motor Transport

917M0015E Moscow *KHIMIYA I TEKHNologiya TOPLIV I MASEL* in Russian No 10, Oct 90, pp 13-14

[Article by S.I. Gorodilova, A.G. Akhmadullina, A.T. Bekbulatova, V.P. Konovalov, and L.N. Shabalina, All-Union Scientific Research Institute of the Scientific Committee, Moscow Petroleum Processing Plant]

UDC 665.725.637.565

[Abstract] The liquified gas, particularly the propane fraction, that was produced by the Moscow Petroleum Processing plant did not meet the standard for use in automobile engines due to the presence of a liquid, oily residue. An analysis of the origin of this fraction was conducted, and measures to eliminate it were proposed. The liquid residue was found to appear in the propane-propylene fraction after monoethanolamine removal of hydrogen sulfide due to the extraction of heavy hydrocarbons; it was also found to persist and increase during further purification. Inadequate removal of gases from the hydrogenize in the high and low pressure separators also contributed to contamination with five-carbon and larger hydrocarbons. IR spectroscopy demonstrated that the residue was more than 50% paraffinic hydrocarbons, 20% aromatics, and 20% naphthenics. Improvements in the procedure for monoethanolamine purification, the use of packless compressors, and either additional rectification or adsorption purification on activated carbon are necessary to correct the problem. Figures 2.

Normalization of Indicators of Working Motor Oil State

917M0015F Moscow *KHIMIYA I TEKHNologiya TOPLIV I MASEL* in Russian No 10, Oct 90, pp 16-18

[Article by V.L. Lashkhi, G.I. Shor, N.I. Skinder, O.Z. Kotelnikova, G.G. Kholostova, and L.V. Borenko]

UDC 621.431:621.892

[Abstract] One of the possible approaches to developing informative parameters indicating the state of motor oil, based on evaluation of the tendency to form precipitates

in an internal combustion engine, was investigated. Correlations were conducted on data obtained from bench testing of production and modified D-160 diesel engines operating with commercial oil for 960 hours. Changes in base and acid number and in coking capacity as well as an accumulation of benzene-insoluble products and iron content were measured. Modeling experiments on a heated metal surface were also conducted. A mathematical expression was derived for the tendency of the oil to form solid particles (II) as a function of the concentration of solid particles in the oil, the ratio of the change in acid number to base number, and the change in viscosity. At values of II below 110, corresponding to an approximate 35% change in viscosity, no significant problems with engine function were noted. This state also corresponds to that achieved after 3 hours of oxidation at 230°C as confirmed by gas chromatography and measurements of enthalpy. Figures 3; references 7: Russian.

Alkylphenols as Biocidal Additives to Hydrocarbon Lubricants for Organic Strands of Steel Cables

917M0015G Moscow *KHIMIYA I TEKHNologiya TOPLIV I MASEL* in Russian No 10, Oct 90 pp 22-24

[Article by Ye.A. Kalichevskaya, V.V. Simashko, P.L. Klimenko, V.D. Sukhovikhov, and T.N. Turchina, MASMA Petroleum Industrial Organization]

UDC 621.892.088.8

[Abstract] The use of 10 alkylphenols of the general formula RC_nH_2OH , where R is a hydrocarbon group of varying chain length and structure, as biocidal additives to hydrocarbon lubricants used on the organic strands of steel cables was studied. Structures were verified by IR spectroscopy and composition by gas chromatography. The alkylphenols were added, at a 10 mass% level, to a model lubricant composed of 84 mass% of a 3:1 mixture of PN-6 oil and I-20A industrial oil, with 3 mass% petroleum Ceresit and 3 mass% ethylene-vinylacetate copolymer. Control experiments demonstrated that this model lubricant does not possess adequate biostability without biocidal additives. When tested alone, the alkylphenols with a branched C_8 or C_9 substituent in the ortho or para position had the greatest biocidal activity. This is probably due to steric hindrance of bacterial contact with the alkylphenol molecule. Polyisobutenyl- and octadecylphenols as well as C_{14} - C_{16} ethylene oligomer-based alkylphenols had low biocidal activity. This may be due to low phenol and hydroxyl group concentration. Isododecylphenol had intermediate activity. When tested in the lubricants, the alkylphenols with a branched C_8 or C_9 substituent in the ortho or para position had the greatest biocidal activity, but that of isododecylphenol was more stable. Alkylphenols containing straight-chain radicals in either ortho or para position, as well as polyisobutylphenol, had practically

no effect on the growth of microorganisms in the lubricant. References 8: Russian.

Effect of Copper Powder on Kinetics of Tsiatim-201 Lubricant Oxidation

917M0015H Moscow *KHIMIYA I TEKHNOLOGIYA TOPLIV I MASEL* in Russian No 10, Oct 90 pp 28-29

[Article by V.V. Butovets, L.M. Kostyuk, and L.V. Zheleznyy, MASMA Petroleum Industrial Organization]

UDC 665.705-404.9.001.5.038.5

[Abstract] The effect of adding copper powder to TsIATIM-201 commercial lubricant on oxidation of the lubricant at 115°C was studied. In addition, the antioxidative stability of copper-containing experimental SM-01"L" and SM-02"L" lubricants, SMP-5 lubricant, and a lithium-type model lubricant was compared to stability without copper. The addition of copper was found to significantly accelerate oxidation. On increasing the copper level in TsIATIM-201 from 0.5 mass% to 10 mass% the induction period was markedly shortened and the rate increased. The mechanism may be catalysis of dissociation of the hydroperoxides present in the lubricant into free radicals. The rate squared was found to be a linear function of copper and hydroperoxide contents. The addition of 2% diphenylamine to TsIATIM-201 containing 5% copper powder had practically no effect on oxidation kinetics. The addition of 2% phenothiazine retarded but did not completely inhibit oxidation. The addition of copper powder, as well as copper oxides or hydroxides, to the lithium-containing model lubricant increased the oxidation rate by a factor of 10. Copper powder also decreased the antioxidative stability of SM-01"L", SM-02"L", and SMP-5. Due to the presence of strong antioxidants in these lubricants, copper did not increase the oxidation rate, although it did abolish the induction period. The results obtained must be considered when developing lubricants with long useful lives. Figures 3; references 6: 5 Russian, 1 Western.

Atomic Absorption Determination of Iron in Petroleum Products

917M0015I Moscow *KHIMIYA I TEKHNOLOGIYA TOPLIV I MASEL* in Russian No 10, Oct 90, pp 31-32

[Article by L.M. Zamilova, V.I. Sokolova, T.G. Biktimirova, and I.I. Ryzhenko, Bashkir Scientific Research Institute for Petroleum Processing]

UDC 665.7:543.4

[Abstract] The choice of optimal sample preparation and analytical conditions was studied for the determination of iron in various petroleum products using a unified atomic absorption method with electrothermal atomization. Samples were introduced into the atomizer dissolved in xylene. To minimize the loss of iron, 600°C was

found to be the best temperature for thermal decomposition of the samples. Disposable pipet tips must be repeatedly rinsed with solvent before each use to remove iron contamination or absorbed sample. Results obtained on four different samples by the method developed were in good agreement with results obtained by indirect atomic absorption or by atomic emission. Agreement was also good when analyzing samples with known iron levels. Relative standard deviations of 7-13% were obtained. Sensitivity was 0.000013%. References 12: 6 Russian, 6 Western.

New Universal Refrigeration Oil KhM-35

917M0033A Moscow *KHIMIYA I TEKHNOLOGIYA TOPLIV I MASEL* in Russian No 11, Nov 90 pp 8-10

[Article by V.A. Potanina, Ye.Ye. Dovgopolyy, T.I. Dremova, A.S. Avanesova, N.I. Begun, V.M. Medem, V.I. Sapronov and N.A. Kazakova, All Union Scientific Research Institute of Petroleum Processing, Production Division "Orsknefteorgsintez", All Union Scientific Research Institute of Refrigeration Machinery]

UDC 621.892:665.76[088.8]

[Abstract] Refrigeration oils should be able to satisfy the requirements of refrigerators in respect to their viscosity and solidification temperature, they should be chemically stable when brought in contact with the refrigerant, their critical solubility temperature should be low, their resistance to construction, condensing and electric insulation materials should be high and they should have excellent lubricating properties. A highly effective universal oil KhM-35 was developed from viscous distillate of low sulfur petroleum using well known processes: purification with phenol, low temperature removal of paraffins and contact purification with bleaching reagents. Physical-chemical characteristics of KhM-35 were compared with the commercial KhA-30 oil. The KhM-35 showed high chemical stability and low aggressiveness towards rubber details; its kinematic viscosity and solubility in R-22 refrigerant was much better. The color of KhM-35 was light because of its low content of tars and polycyclic aromatic hydrocarbons. Evaluation on KhM-35 on model refrigerators showed that its physical-chemical properties remained stable; a 5,000 hr life cycle was approved for its use between oil changes. Figure 1.

Oil From Sulfur Petroleum for Steam Engines

917M0033B Moscow *KHIMIYA I TEKHNOLOGIYA TOPLIV I MASEL* in Russian No 11, Nov 90 pp 10-11

[Article by E.B. Ivankina, N.I. Grigoryeva, K.M. Badyshtova, S.A. Chesnokov and V.M. Belyakov, Kuybyshev Branch of All Union Scientific Research Institute of Petroleum Processing, Kuybyshev Institute of Railroad Transport Engineers]

UDC 665.765-404:665.61:621.89

[Abstract] Highly viscous cylinder oils 38 and 52 are used in lubricating steam engine cylinders; these oils are prepared from Bakinsk and Embensk petroleum with low sulfur content. Because this resource began to dry out, it was necessary to find an equivalent substitute. It was shown that such an oil can be obtained from sulfurous petroleum P-40, a highly viscous oil from West Siberian deposits. It exhibited relatively low viscosity (viscosity class 680 at 40°C) and flash point (above 250°C). It prevented carbon deposits and its lubricating properties were excellent, making it a promising substitute for the oils 38 and 52. The P-40 oil properties were improved by addition of polyisobutenes of varying molecular weight and additives octol-600A, KP-10 and P-85. Figure 1; references 6: 5 Russian (1 by Western authors), 1 Western.

Effect of Admixtures in Gases From Petroleum Processing on Life of Hydrogen Production Catalysts

917M0033C Moscow *KHIMIYA I TEKHOLOGIYA TOPLIV I MASEL* in Russian No 11, Nov 90 p 12

[Article by Yu.M. Baranov, S.N. Goncharuk, T.S. Aleksashina and T.Ye. Alymova, All Union Scientific Research Institute of Petroleum Processing]

UDC 661.961.621

[Abstract] Increased petroleum processing made it necessary to expand production of hydrogen on petroleum processing plants. One of the most practical methods of hydrogen production is based on steam condensation of hydrocarbon gases. Catalysts used in this process are easily poisoned by sulfur compounds. Because of the fact that hydrocarbon gases used in production of hydrogen originate at many sites, their composition is varied. A number of other components of steam and hydrocarbon were analyzed as they affected the overall yield and performance of the catalyst. The authors cautioned that strict control of the composition of the components used in production of hydrogen from petroleum gases must be maintained. References: 3 (Russian).

Purification of Residual Crude on Adsorbents of Different Origins

917M0033D Moscow *KHIMIYA I TEKHOLOGIYA TOPLIV I MASEL* in Russian No 11, Nov 90 pp 13-14

[Article by P.Yu. Serikov and V.N. Yarkin, All Union Scientific Research Institute of Petroleum Processing]

UDC 665.65[088.8]

[Abstract] Condensation of crude cracking material leads to deactivation of catalysts because of the deposition of V, Ni and other metals on their surfaces. Several adsorbents were tried in purifying attempts of this crude.

Troshkovskaya clay, aluminum silicate, aluminum oxide and coke from thermal contact cracking. Experiments showed that the largest number of byproducts was obtained from the neutral coke; the highest yield of the desired product, overt aluminum oxide. Overall, it was shown that the purification process is both catalytic and thermal for the clay and for aluminum silicate; aluminum oxide and neutral coke favor strictly the thermal reaction. In spite of individual differences observed with these reagents, a 93-99% purification was achieved for vanadium and 92-96% for nickel. Thus, a desired goal could be obtained regardless of the nature of the purification process. References 6: 3 Russian (1 by Western authors), 3 Western.

Heat Conductivity of Coke Deposits in Tempering-Evaporating Apparatus on Pyrolysis Installations

917M0033E Moscow *KHIMIYA I TEKHOLOGIYA TOPLIV I MASEL* in Russian No 11, Nov 90 pp 18-20

[Article by V.V. Maksimovskiy, E.A. Raud, O.A. Sokolov, I.V. Korsak and M.A. Chepovskiy, Obninsk Institute of Atomic Energy, All Union Scientific Research Design Institute of Petroleum]

UDC 665.692-536.2.002

[Abstract] Literature data on heat conductivity of coke deposits forming during pyrolysis are scarce. The goal of this work was to determine the coefficients of heat conductivity of these coke deposits as a function of temperature and structure of the coke. It was shown that laminated coke exhibits higher density and lower porosity than the slag coke. Analysis of the experimental data obtained showed that the heat conductivity coefficient of all types of pyrolytic coke (the slag, the disorganized and the laminated ones) increased with the increase in temperature and density of the coke. Figures 4; references: 7 (Russian).

Characteristics of Phase Transitions in Hydrocarbons of Residual Oils

917M0033F Moscow *KHIMIYA I TEKHOLOGIYA TOPLIV I MASEL* in Russian No 11, Nov 90 pp 29-31

[Article by S.G. Agayev, M.G. Sheveleva and L.A. Shabrova, Tyumen Industrial Institute imeni Lenin Komsomol]

UDC 629.7:621.89

[Abstract] Petroleum oils are highly associated liquids. As a results of temperature variation, structural changes occur in such oils accompanied by the changes in dielectric properties, which determine their performance characteristics. Residual oils and their components were studied by means of the frequency-temperature dielectric spectroscopy which is capable of adjusting phase

transitions resulting from internal rotation of the molecules. It was shown that there exists a dielectric relaxation in the semiconductor hydrocarbon molecules. This indicates a phase transition in such system from glass-like state to an associated state. The temperatures corresponding to the extremes at the $\epsilon(t)$ and $\tan \delta(t)$ functions indicate oil hydrocarbon vitrification, which limits the lower temperature range of their performance capacity. Figures 3; references 9: 8 Russian, 1 Western.

Evaluation of Corrosion Factor of Metal Wear in Lubricants

917M0033G Moscow *KHIMIYA I TEKHNLOGIYA TOPLIV I MASEL* in Russian No 11, Nov 90 pp 32-34

[Article by L.A. Bronshteyn, G.V. Privezentseva and Ye.V. Pashkov, All Union Scientific Research Institute of Petroleum Processing]

UDC 620.193.7:621.892

[Abstract] The goal of this work was to determine the electrochemical component of corrosion wear resulting from electrochemical corrosion preceding friction. The effect of the composition of the lubricant on metal wear subjected to corrosive action of an electrolyte was determined by TEM-1 methodology using the following lubricants: petroleum and synthetic basic oils, engine oils, transmission oils with additives, preservation oils, various additives and corrosion inhibitors. Depending on the composition and property of the oil used, the wear ranged from 0 to 47%. Better results were obtained with the oils TAD-171 and M16-1KhP-3, the additive PAF-4 and corrosion inhibitor NG-107M. Figures 23.

Composition of Alkanes in Residual Oils

917M0037A Moscow *NEFTEKHIMIYA* in Russian Vol 30 No 3, Sep-Oct 90 (manuscript received 10 Jan 90) pp 585-592

[Article by R.N. Fakhretdinov, N.K. Lyapina, M.A. Parfenova, R.Kh. Startseva, N.V. Davidenko, G.A. Glebov and L.N. Gagarina, Scientific Production Association "Soyuznefteotdacha", Ufa, Institute of Chemistry, Bashkir Scientific Center, Ural Division of USSR Academy of Sciences, Ufa]

UDC 665.7.033.22

[Abstract] Composition of residual oils from Arlansk, Ishimbaysk and Urshak deposits of Bashkiriya, Volga-Ural Province were analyzed by gas-liquid chromatography and chromatography-mass spectroscopy methods

and compared with samples of the oil being pumped presently. Structural group composition and molecular mass distribution of alkanes in these oils were studied in particular. Alcohol-benzene extracts of these oils contained material with high molecular weight (500-600), high sulfur content (3.9-5.24%), oxygen (2.76-3.69%) and nitrogen (0.61-1.01%). Arlansk and Urshak oils were similar in respect to their content of paraffine-naphtene hydrocarbons; paraffine content in Ishimbaysk oil was considerably higher (30%). The content of aromatic hydrocarbons was 28-32% in all of the tested samples. The total content of isoparaffine and naphtene hydrocarbons was 18-28%, much lower than in the oils being pumped (40%). Overall, these residual oils contain up to 10% n-alkanes and 2% of isoprene alkanes; the methane series hydrocarbons (fraction 200-400°C) comprise about 60% of their contents. These residual oils were evidently generated by a sapropelic organic material in a highly reducing medium during diagenesis and were not subjected to biodegradation and polycondensation. Figures 2; references: 9 (Russian).

Hydrogenation of Toluene Over Composite Catalysts Containing ZrNiH_x Hydride

917M0037B Moscow *NEFTEKHIMIYA* in Russian Vol 30 No 3, Sep-Oct 90 (manuscript received 16 Jan 90) pp 593-597

[Article by K.A. Manovyan, V.V. Kiselev, G.V. Voronina, L.V. Voronova and V.V. Lunin, Moscow State University imeni M.V. Lomonosov]

UDC 66.094.172:[541.412:681:39]

[Abstract] Toluene hydrogenation was investigated on novel composition catalysts based on ZrNiH_x in which a bemite-talum mixture was used as the carrier (talum is a strong cement consisting of a mixture of calcium di- and mono-aluminates ($\text{CaAl}_2\text{O}_4 \cdot \text{CaAl}_4\text{O}_7 = 1:4$). Depending on the temperature, three reactions were observed: up to 448 K - toluene hydrogenation, at 563 K - hydrodemethylation, and hydrocracking at temperatures > 553 K. The mechanical strength of the catalyst dropped with increased content of ZrNiH_x hydride because of its oxidation with water evolving from the carrier at the calcination stage. To increase the mechanical strength of the catalyst, the hydride used should be pre-activated and should not exceed 30% of the mass of catalyst. The ratio of bemite:talum should be in the range of 40:60 to 60:40. Figures 2; references 7: 6 Russian, 1 Western.

Influence of Chlorine-, Nitrogen- and Resin-Containing Admixtures During Hydrogenation of Unsaturated Hydrocarbons Over Palladium Catalysts

917M0037C Moscow NEFTEKHIMIYA in Russian Vol 30 No 3, Sep-Oct 90 (manuscript received 4 Sep 89) pp 598-601

[Article by L.V. Shalimova, A.D. Berents, T.V. Murzova and Ye.Ye. Kugucheva, All Union Scientific Research Institute of Organic Synthesis, Moscow]

UDC 665.658.26:678.044:546.621:546.98

[Abstract] Experimental results were reported of the influence of chlorine, nitrogen and resin containing substances on the hydrogenation activity of palladium catalyst in metallic and sulfide forms. The experiments were performed in a flow apparatus at a 4 atm pressure, the temperature ranging from 50 to 150°C, analyzing hydrogenation of hexene-1, indene, *α*-methylstyrene and dicyclopentadiene. In all cases the catalyst in the metallic form was more active than in the sulfide form. Presence of various impurities lowered the activity of the catalyst, especially at 50°C. Purging the catalyst with hydrogen at 200°C reconstituted its activity; evidently the impurities cover its surface, limiting its access to the unsaturated hydrocarbons. Limiting levels of various impurities were

determined: for chlorine it was 500 ml⁻¹, for the corrosion inhibitor IKB-22 - up to 50 ml⁻¹ and for the resins - not more than 20 mg/100 ml. Figures 2; references: 2 (Russian).

Oxidation of Gas Oil 200-210°C Fraction From Catalytic Cracking of Azerbaijan Shirvanskiy Deposit Petroleum

917M0050J Leningrad ZHURNAL PRIKLADNOY KHIMII in Russian Vol 63 No 10, Oct 90 (manuscript received 18 Jul 89) pp 2353-2357

[Article by A.I. Akhmedov, B.K. Zeynalov, M.N. Magerramov, M.I. Rud, and S.P. Godzhayev]

UDC 547.659.542.948

[Abstract] A study is made of the oxidation of gas oil distillate obtained at a Baku refinery. Both broad and narrow fractions of the gas oil distillate were oxidized. Mass-spectrometric analysis indicates that the 200-300°C gas oil fraction consists primarily of aeromatic hydrocarbons with some paraffin and naphthene hydrocarbons. The study showed that the broad gas oil fraction is practically not subject to oxidation, and therefore 10° fractions between 190 and 200°C were oxidized. The aeromatic acids obtained by oxidation of the gas oil fraction are suitable for use as raw materials for the production of sulfonates. The aeromatic acids are produced by oxidizing the narrow 200-210° fraction, with a yield of 55%. References 7; Russian.

Polymer Composition Materials Based on Polyimide Binder*917M0063A Moscow PLASTICHESKIYE MASSY in Russian No 12, Dec 90 pp 18-20*

[Article by V.N. Tyukayev, B.V. Yerzh, V.V. Yunnikov, O.V. Mikhina, V.M. Semenin, O.Ya. Kopylova, Ye.R. Borovikova, L.A. Stepanycheva and A.V. Medvedevskaya]

UDC 678.766.067.5.01

[Abstract] Among the available polymer composition materials, polyimides are of great practical interest because they can be used in temperatures up to 523-573 K. Polyimide binders such as PAIS (maleinamidoimide oligomers) are interesting in that they emit no volatile material during the solidification process, they are very reactive and do not require high temperatures for their reactions. A new binder TP-80 was developed from such PAIS oligomer; it could be safely stored for up to one year packaged in polyethylene bags. This binder was used in manufacturing glass-, carbon- and organic plastic materials. Physical-chemical properties of a number of end products were reported showing that they were comparable to epoxy plastics. These novel plastic materials could be produced on the equipment currently used in manufacturing various plastic products. References: 2 (Russian).

Automated Design System for Composition Materials*917M0063B Moscow PLASTICHESKIYE MASSY in Russian No 12, Dec 90 pp 24-28*

[Article by S.V. Belkin]

UDC 678.046.001.2:681.3

[Abstract] An automated system for design of new composition materials (CM) was developed with the goal of increasing the productivity of the designers, lowering the time required for the design of new materials and of the experimental costs incurred as well as optimizing specific application results. The principal design objects considered by this system are CM, their components, multilayered and multi-component coatings and intermediate products. Past experience showed that the correct approach to this problem is to properly formulate the task. The general design of this program consists of three stages. At the first stage the CM is treated as a system, the components of CM as its sub-systems and the total composition construction as the super-system. Approximate design proposals for CM are obtained during phase two with optimized technical requirements and phase three fine-tunes and optimizes the project design. Each of these phases consists of a number of sub-processes, second phase providing the most crucial design step. It consists of conceptualization, selection of

components, selection of accessories, selection of the binder, the technological process and preliminary optimization. Figures 3.

Structural and Mechanical Characteristics of Impact Resistant Polystyrene Modified With Block-Copolymers*917M0063C Moscow PLASTICHESKIYE MASSY in Russian No 12, Dec 90 pp 38-41*

[Article by K.A. Vylegzhanina, O.K. Belomutskaya, G.D. Ballova, M.G. Rozhavskiy and V.G. Rupyshev]

UDC 678.746.222-13.01:539.2

[Abstract] Modification of impact resistant polystyrene (IRP) with styrene-butadiene block copolymers at the stage of its synthesis improves its physical-chemical properties at low investment of additional resources. The structure of the dispersed phase was investigated along with the methodology of the production of these thermal plastic materials. It was shown that modification of butadiene based IRP with star shaped block-copolymers resulted in an increased impact resistance due to the formation of a hybrid structure phase consisting of two types of particles: ovate and capsular, with increased adhesion at the phase separation borders. The impact resistance of such materials increased 1.5 fold; the breaking point during stretching and relative elongation at the breaking point were not affected. Figures 2; references 7; 6 Russian (1 by Western author), 1 Western.

Prediction of Heat Capacity Changes of Film Forming Polymers Based on Their Heat Conductivity*917M0063D Moscow PLASTICHESKIYE MASSY in Russian No 12, Dec 90 pp 51-53*

[Article by T.N. Kyshtymova, P.P. Pugachevich and Yu.V. Zeleney]

UDC 678.7.488.536.63

[Abstract] Phenomenological theory makes it possible to calculate physical-chemical characteristics of individual substances and their mixtures in equilibrium and in non-equilibrium situations. According to this theory, real, repetitive, well defined and continuous relationships exist between any generalized values of the dynamic linear system. For a given system consisting of a final number of components whose behavior is characterized by generalized values, it is possible to write a linear differential equation according to which the elemental change dQ of a value Q is proportional to the magnitude Q and an elemental value of dq of an independent variable q : $dQ=vQdq$, where v is the coefficient of proportionality. Specific heat capacities of nylon-6,

polyhydroxymethylene, low and high pressure polyethylene were calculated for a wide range of temperatures. References: 3 (Russian)

Catalytic Purification of Exhaust Gases at Synthetic Resin Fabric Treatment Plant

917M0063E Moscow PLASTICHESKIYE MASSY
in Russian No 12, Dec 90 pp 65-67

[Article by V.P. Balabanov, G.N. Toropkina, M.I. Novokovskaya and A.V. Kiyashko]

UDC 678.632'32'21:539.219.1

[Abstract] During the impregnation process of the fiber-glass and asbestos fabrics with phenol-formaldehyde and epoxide resins dissolved in acetone, toluene, ethanol, butylacetate, etc., gas discharges are formed polluting the environment around the plant. A commercial gas purification unit was used to purify these exhausts from toxic substances using the catalyst IKT-12-3. The degree of purification for the above solvents was 92-99%, phenol was removed completely. Carbon dioxide, epichlorohydrine and hydrogen chloride were not detectable in the purified gas. At the temperature 410-425°C the IKT-12-8 catalyst performed adequately only for 500-600 hours. When the temperature was lowered by 20-30%, the life span of the catalyst increased to 1,000-1,500 hours but its efficiency in purifying the exhaust gas was lowered. After becoming inactive, the catalyst should actually be replaced with N1106A2-8D and AP-56 catalyst which last up to 5 years. Figure 1.

Local Installations for Combustion of Industrial Wastes

917M0063F Moscow PLASTICHESKIYE MASSY
in Russian No 12, Dec 90 pp 67-68

[Article by G.D. Kalinovskaya and A.F. Posherstnik]

UDC 678.027.94.02:628.543

[Abstract] Even though the production of laminar plastics produces no liquid waste, associated operations such as clean up produce about 900 tons of liquid waste annually on a typical plant. This effluent is dumped into the municipal sewage system. Searching for a suitable method of this waste disposal, it was discovered that the most effective method was based on combustion purification of liquid wastes, developed at the Institute imeni Polzunov in Leningrad. The end products of this purification include steam, carbon dioxide, molten salts and small quantity of nitrogen oxides; a 99% purification level is achievable and the annual cost is about 100,000 rubles with about a 100,000 rubles of initial investment in the equipment. This appears to be economically sound in comparison to current operations. The exhaust gasses could easily be purified by a catalytic method using a copper-chromium catalyst IKT-12-8. References: 4 (Russian).

Modification of the Structure of Segmented Polyurethanes by the Thermal Fixation of Their Oriented State

917M0068D Kiev UKRAINSKIY KHIMICHESKIY
ZHURNAL in Russian Vol 57 No 2, Feb 91
(manuscript received 28 Dec 89) pp 208-211

[Article by S.B. Laptiy, Yu.Yu. Kercha, L.G. Balitskaya, Zh.G. Yurchik, and A.F. Lebedev, Chemistry of High-Molecular Compounds Institute, UkSSR Academy of Sciences, Kiev]

UDC 541.64:539.2

[Abstract] Unlike chemically cross-linked polyurethane elastomers, segmented polyurethanes are characterized by creep and are not fully restored after cyclic loads. Reducing these shortcomings or eliminating them entirely so that segmented polymers may be used to produce a polymer product with the required viscoelastic properties requires localizing and fixing the strong physical (hydrogen) bonds in polyurethane in the region of the rigid segments. This may be done by using thermal and deformation effects. In an effort to gain more information in this area, the authors of this article conducted an IR spectroscopy study of the structure of oriented films of segmented polyurethane as a function of the temperature at which the structure is fixed. The segmented polyurethane used in the experiments was synthesized on the basis of oligoethylenebutylene glycol adipate, 4,4-diphenylmethane diisocyanate, and dihydrazide of dibasic acid by a two-stage method. The films used in the studies were prepared from a 7% solution of polymer in dimethyl formamide at 60°C. Their IR spectra were recorded on a UR-20 IR spectrometer using an RPI-3-01 film polarizer. The dichroism of the band of valence oscillations of CH₂ groups located primarily in the smooth segments were used to judge the orientation of the smooth oligoester segments. The orientation of the rigid segments was judged on the basis of the dichroism of the band of valence oscillations of the NH-groups. The structure of the specimens was fixed at selected temperatures (90, 100, 110, 120, and 140°C) during different degrees of elongation (300, 400, and 500%). The elongations for the subsequent thermal fixations of the oriented states of the segmented polyurethanes were selected on the basis of the curves of the mechanical tests and based on current ideas regarding the restructuring of the rigid-segment domains of polyurethanes during deformation. The thermal fixation tests performed revealed that when the test specimens were prestretched to elongations between 300 and 500%, the optimal range of annealing temperatures turned out to be between 110 and 130°C. It is in this temperature range that one can observe the maximum degree of orientation of the rigid segments coupled with the complete disorientation of the smooth segments and the maximum degree of microstratification in the system. The experiments further demonstrated that this type of morphology of segmented polyurethane films gives them

a high modulus and stability when subjected to cyclic loads. Figures 2, table 1; references 5: 4 Russian, 1 Western.

Segmented Oligoetheurethanes for Powder Technology

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ZHURNAL in Russian Vol 57 No 2, Feb 91
(manuscript received) pp 211-214

[Article by T.L. Malysheva and V.F. Matyushov, Chemistry of High-Molecular Compounds Institute, UkSSR Academy of Sciences, Kiev]

UDC 678.664

[Abstract] Thermoplastic segmented polyurethanes are generally used to produce products from polyurethane elastomers based on powder technology. Their use is significantly restricted, however, owing to the high softening temperature and viscosity of these polymers.

Hence the need to develop a low-melting powder composite based on low-molecular segmented oligoetheurethanes with reactive groups. The authors of this article examined this type of oligomer by way of the example of a homologous series of polyetheurethanes based on polyoxytetramethylene glycol with a molecular mass of 1,000, 4,4'-diphenylmethane diisocyanate, and butane diol. The thermophysical properties of the polymer homologues were examined on a DSM-2M scanning calorimeter in the temperature interval from 153 to 473 K at a heating rate of 2 K/min. Their rheological properties were examined on a Reotest-2. It was discovered that for polymer homologues with a molecular mass below the critical molecular mass, the brittle point determines the transition to a viscofluid state. It was further discovered that thanks to their low softening temperature and viscosity, oligomers with reactive end groups from the subcritical range of molecular masses are interesting as possible principal components of composites for use in producing elastomer coatings by powder technology. Figures 3, table 1; references 7: 4 Russian, 3 Western.

Linear Equilibrium Dynamics of Radiation-Adsorption Process of Water Purification From Chemical Impurities

917M0038A Moscow *KHIMIYA VYSOKIKH ENERGIY* in Russian Vol 24 No 6, Nov-Dec 90
(manuscript received 29 Jun 89) pp 506-508

[Article by S.A. Dyagilev and V.N. Shubin, Institute of Electro-Chemistry imeni A.N. Frumkin, USSR Academy of Sciences]

UDC 541.15

[Abstract] The available mathematical model of the dynamics of radiation-adsorption purification of natural and effluent waters has been developed for microbiological contaminants. In the present paper a model was presented for purification of water from chemical impurities for the case of linear and equilibrium process dynamics. Frontal purification procedure was used as the study case. It was shown that the radiation factor leads to an exponential quenching of the adsorption "wave" extended down the purification column, resulting from radiation breakdown of the impurity coupled with an increase rate of its movement down the column, the latter being the result of a faster filling of the elementary adsorbent layer with the material, all the way to the equilibrium level. A mathematical reasoning was presented for the earlier observation of prolonged radiation-adsorption purification process. An equation was developed for evaluating the existing facilities based on the principal parameters of radiation-adsorption purification: thickness of the adsorbent layer, cross-section of the column, flow rate, radiation dose, initial contamination, the type of adsorbent used and chemical impurity itself. References 8: 7 Russian, 1 Western.

Destruction of Poly-2-Methyl-5-Vinyltetrazole by Action of γ -Radiation

917M0038B Moscow *KHIMIYA VYSOKIKH ENERGIY* in Russian Vol 24 No 6, Nov-Dec 90
(manuscript received 20 Apr 89) pp 509-513

[Article by A. T. Govorkov, M. P. Fomina and Ye. A. Bannova, Kemerov State University]

UDC 541.14:547.796.1

[Abstract] The effect of γ -radiation on poly-2-methyl-5-vinyltetrazole (PMVT) was investigated using the IR and EPR spectroscopy, rheo-viscosimetry and capillary viscosimetry, gas chromatography and chemical analysis. Air irradiation effects on the rupture of macro-chain bonds, the breakdown of the tetrazole ring with elimination of nitrogen and accumulation of carboxylic groups was observed. The viscosity of the solutions used in this study and molecular weight increased with the exposure to γ -radiation, indicating an interactive effect of several factors. This increase in viscosity was related to structuralization processes occurring in DMFA and DMSO.

When the adsorbed dose reached 200 kGr, an equilibrium was reached between the destructive and structuralizing processes as the viscosity did not increase any more. The breaking of the macro-chain bonds occurred most probably in the tail-tail fashion. The other processes observed were no different from those occurring in thermal breakdown of PMVT. Figures 4; references: 15 (Russian, 2 by Western authors).

Radiation Hydrolysis of Brown Coal

917M0038C Moscow *KHIMIYA VYSOKIKH ENERGIY* in Russian Vol 24 No 6, Nov-Dec 90
(manuscript received 28 Feb 89) pp 514-517

[Article by O.S. Povolotskaya, A.V. Rudnev and Ye.P. Kalyazin, Moscow State University imeni M.V. Lomonosov]

UDC 541.15:662.642

[Abstract] The goal of this work was to investigate the effect of ionizing radiation on hydrolysis of brown coal from the Irsh-Borodinsk deposits, Kansk-Achinsk coal basin. When brown coal was heated (320-470°C) in a stream of nitrogen, methane and hydrogen were seen in the gas evolving from the reactor with some CO admixture; when hydrogen replaced the nitrogen gas, the reaction products also included ethane, ethylene, propane and butane. When the process temperature was established, the gas evolution rate diminished sharply. Irradiation of the mixture led to a rapid increase of the gas evolution. In all cases the gas evolution rate went through a maximum, dropping sharply after that point; each successful irradiation repeated the gas evolution rate increase but successfully to a lesser extent. In the temperature range of 365 to 470°C, methane and ethane were formed with energy of activation of 106 and 80 kJ/m respectively. The results were explained by radical reactions initiated by the ionizing radiation of the coal mass. The mechanism of this process was discussed in great detail. Figures 2; references 16: 12 Russian, 4 Western.

Action of Different Types of Ionizing Radiation on Polymer Properties, Heat Conductivity and Crystalline Properties of Polyethylene

917M0038D Moscow *KHIMIYA VYSOKIKH ENERGIY* in Russian Vol 24 No 6, Nov-Dec 90
(manuscript received 6 May 89) pp 518-522

[Article by B.A. Briskman, Z.N. Chikina, V.N. Rogova and A.I. Noyfekh, Scientific Research Physical-Chemical Institute imeni L.Ya. Karpov]

UDC 541.64:536.6:539.26

[Abstract] Data on the specific effect of different types of ionizing radiation in vacuum at 77 and 300 K on the property of polyethylene are conflicting: the radiation-chemical yields of the primary products may decrease or

increase with intensification of LPE, the radiation-chemical yields of cross-linking and destruction are not related to LPE, etc. In the present work a comparative investigation was carried out of the radiation effects on high and low density polyethylene (HDPE and LDPE respectively) using ^{60}Co γ -quanta with 100 MeV energy and neutrons from an atomic reactor. Specifically, the effect of irradiation on the coefficient of heat conductivity λ and mass crystalline properties in HDPE and LDPE were investigated in the temperature range of 248 to 373 K. It was established that the highest effect on heat-physical properties of polyethylene was shown by the neutrons. The specificity of radiation action depended on the organizational level of the polymer structure. Figures 4; references 15: 9 Russian, 6 Western.

Formation of Chloride Phase on Surface of Alkali Metal Perchlorate Crystals During UV-irradiation

917M0038E Moscow *KHIMIYA VYSOKIKH ENERGIY* in Russian Vol 24 No 6, Nov-Dec 90 (manuscript received 2 Dec 88, after final revision 24 Nov 89) pp 529-532

[Article by R.Sh. Khaliullin, V.M. Pugachev and B.A. Khisamov, Kemerov State University]

UDC 541.14

[Abstract] Illumination of solid KClO_4 with a 185 nm wavelength at 77 K leads to an effective photochemical breakdown of the perchlorate ion with formation of a series of ClO_x^- ($x = 0, 1, 2, 3$) type ions and oxygen. During a study of the photolysis of alkali metal perchlorates at 198 K, formation of a special chloride phase over the illuminated crystalline surface was observed. This work was devoted to the investigation of the mechanism of the formation and growth of the product phase during photolysis of solid perchlorates MClO_4 ($\text{M} = \text{K, Rb, Cs}$). It was shown that the principal product in this process was the chloride of the corresponding metal forming an oriented phase on the surface of the experimental

sample. The continued growth of this phase after cessation of the irradiation is the result of a combination of processes: generation of the " O_2 " type oxygen complexes in the solid, their migration towards the surface and distribution of the complex components at the surface. Figures 3; references 5: 3 Russian, 2 Western.

Kinetics of Plasma Chemical Polymerization of Light ($\text{C}_1\text{-C}_2$) Hydrocarbons in low Pressure Glowing Discharge

917M0038F Moscow *KHIMIYA VYSOKIKH ENERGIY* in Russian Vol 24 No 6, Nov-Dec 90 (manuscript received 30 Mar 89) pp 541-545

[Article by Yu.A. Ivanov, N.M. Rytova, V.N. Timakin and I.L. Epshteyn, Institute of Petrochemical Synthesis imeni A.V. Topchiev, USSR Academy of Sciences]

UDC 532.224:541.1

[Abstract] The mechanism of plasma-chemical polymerization of organic compounds in low pressure glowing discharge have been discussed repeatedly in the literature. The authors proposed a mathematical model for the case of light hydrocarbons in steady current discharge (SCD). In the present paper a modified model was used for the kinetics of film formation in SCD and a mixture of $\text{Ar} + 2\% \text{CH}_4$ in pure methane and in high frequency discharge in pure ethane. Using this model it was possible to describe experimental data on the polymer film (PF) formation rate in the discharge of undiluted methane or ethane and in mixtures with inert gasses. The mechanism of the growth of PF changed depending on the internal discharge parameters (chemical composition and temperature of the gas) and on the time the gas was exposed to the discharge. With short exposures the film grew by additions of the radicals to the free bonds on the surface layer of the developing PF and as the result of direct insertion of hydrocarbon ions. With increased exposure time, when low molecular C_nH_x products were formed, the film grew by the "adsorption" mechanism. Figures 4; references 22: 12 Russian, 10 Western.

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